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, November 15, at 1:00 p.m. by WebEx and in-person (Room: C- 2045).

AGENDA

1. **Regrets**
2. **Adoption of the Minutes of October 18, 2023** (pages 3-7)
3. **Business Arising from the Minutes**
4. **Correspondence:** No Correspondence
5. **Reports of Standing Committees**:

    A.   **Undergraduate Studies Committee**:

    Presented by Shannon Sullivan, Chair, Undergraduate Studies Committee

    a. Department of Biology – Calendar Changes, cross-list existing Biology 4911, with Ocean Sciences, amend course title, update course description. Paper 5.A.a (pages 18-23)

    b. Department of Computer Science – Calendar Changes, eligibility wording change and honours project change, Co-operative Internship in Computer Science (CICS) , Paper 5 A. b. (pages 24-31)

    c. Department of Computer Science – Calendar Changes, Minor in Computer Science, Paper 5 A. c. (pages 32-40)

    d. Department of Computer Science – Calendar Changes, amend course, Computer Science 2001, 2002, 2003, Paper 5 A. d. (pages 41-48)

    e. Department of Computer Science – Calendar Changes, New course proposal, Computer Science 3019, Paper 5 A. e. (pages 49-53)

    f. Department of Computer Science – Calendar Changes, New course proposal, Computer Science 3730 Paper 5 A. f. (pages 54-61)

    g. Department of Computer Science – Calendar Changes, New course proposal, Computer Science 3766, Paper 5 A. g. (pages 62-67)

    h. Department of Computer Science – Calendar Changes, New course proposal, Computer Science 4019, Paper 5 A. h. (pages 68-72)

    i. Department of Computer Science – Calendar Changes, Amend course, Computer Science 4304, Paper 5 A. i (pages 73-79)

    j. Department of Mathematics and Statistics – Calendar Changes, amend course, Mathematics 1051, Paper 5 A. j. (pages 80-92)

    k. Department of Mathematics and Statistics – Calendar Changes, amend course, Mathematics 3161 and 4160, Paper 5 A. k. (pages 93-109)

    l. Department of Mathematics and Statistics – Calendar Changes, amend course, Mathematics 4162, Paper 5 A. l. (pages 110-117)

m. Department of Mathematics and Statistics – Calendar Changes, Mathematics Majors/Honors degree –Mathematics 2030/3030/409A/B, Paper 5 A. m. (pages 118-140)

B. **Graduate Studies Committee:**

C. **Library Committee:** No business

6. **Report of the Dean:**

7. **Question Period**

8. **Adjournment**

Travis Fridgen, Ph.D.
Interim Dean of Science

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

FACULTY OF SCIENCE
FACULTY COUNCIL OF SCIENCE
Minutes of Meeting of October 18, 2023

A meeting of the Faculty Council of the Faculty of Science was held on Wednesday, October 18, 2023, at 1:00 p.m. using a hybrid model of WebEx and in-person (C-2045).

FSC 3029   **Present**

Biochemistry
M. Berry, R. Bertolo,

Biology
A. Chaulk, E. Edinger, D. Harvey, J. Purchase, M. Rise, Y. Wiersma

Business Administration
M. Eghbali-Zarch

Chemistry
H. Grover, F. Kerton, C. Kozak, S. Pansare, N. Ryan, S. Smith, T. Stockmann

Computer Science
S. Bungay, A. Fiech, C. Hyde, K Liu

Earth Sciences
A. Langille, K. Welford

Economics
K. Chu

Mathematics & Statistics
J. Alam, I. Booth, R. Haynes, J.C. Loredo-Osti, T. Sheel, T. Stuckless, S. Sullivan

Ocean Sciences
I. Fleming, P. Gagnon, D. Inkpen, C. Parrish, M. Rise, J. Wroblewski

Physics & Physical Oceanography
D. Coombs, E. Hayden, H. Neilson, I. Saika-Voivod, L. Zedel

Psychology
S. Blandford, K. Hourihan, C. Thorpe,

Dean of Science Office
J. Blundell, C. Hussey, S. Dufour, M. Fitzpatrick, T. Fridgen, T. Mackenzie, R. Newhook, R. Temple

Student Representatives
S. Akter, H. Butt, S. Duglas, J. Dwyer, J. Lamarre, A. Ullah, N. Vadood

Guests
Dr. Lee Ann McKivor,
Dr. Svetlana Barkanova

FSC 3030   **Adoption of Minutes**
Moved: Minutes of the meeting of September 20, 2023, be adopted. (Sullivan/ Loredo-Osti) **Carried.**

FSC 3031   **Business Arising:** No Business

FSC 3032   **Correspondence:** No Report

FSC 3033   Benefits of Senate involvement and of how faculty members can get involved: Presented by Dr. Lee Ann McKivor, University Registrar and Interim Secretary of Senate

Dr. McKivor shared information about senate and its role at Memorial. On Senate, there are 9 seats currently vacant. If you are interested in becoming involved with Senate, please email senate@mun.ca. Responsibilities of Senate committees include (but are not limited to): Curriculum and Academic Policy matters, Convocation, and Academic Governance; through their work, these committees provide input and make recommendations to the Board of Regents. (.pdf of presentation attached)

FSC 3034   **NSERC CISE:** Dr. Svetlana Barkanova, NSERC Chair for Inclusion in Science and Engineering (Atlantic)

This program builds on the NSERC Women in Science and Engineering (WISE) program that supports 5 chairs in 5 regions of Canada. Through the new CISE (Chair for Inclusion in Science and Engineering) program, Atlantic Canada has the first chair through a 2-year pilot program. This will support underrepresented groups across the region, including but not limited to women, Indigenous peoples, and persons with disabilities, racialized groups, and members of LGBTQ2+

communities. For more information or questions, contact Dr. Barkanova at
sbarkanova@grenfell.mun.ca

There are upcoming summer projects including summer camps and the total solar
eclipse, which will be visible from several parts of our province on April 8, 2024.

FSC 3035   Reports of Standing Committees:

    A.   Undergraduate Students Committee:
Presented by Shannon Sullivan, Chair, Undergraduate Students Committee
a.   Department of Mathematics and Statistics - Calendar Change,
Amend Course – MATH 2000, (Sullivan/Booth) **Carried**.
b.   Department of Chemistry - Special Topics course CHEM 4391,
Approved by FOSCUGS and presented to Faculty Council for information
only.
c.   Department of Biochemistry **-** Calendar Changes BIOC 4242
Special Topics in Nutrition –HUBI 4700 Field Stud Nutr Health,
(Sullivan/Bertolo) **Carried**.
d.   Department of Biochemistry – Calendar Changes – Human
Biosciences 4701 Culture, Food and Health -HUBI 4701 Culture Food
Health, (Sullivan/Bertolo) **Carried.**
    B.   Graduate Students Committee: No Business
    C.   Library Committee: No Business

FSC 3036   Committee Matrix:
Presented by Suzanne Dufour, Associate Dean (Undergraduate and
Administration):
The Committee Matrix is updated and posted on-line (Committees | Faculty of
Science | Memorial University of Newfoundland (mun.ca)). (Dufour/Sullivan)
Carried.

FSC 3037   Report of Dean:

Carbon Capture Utilization and Storage
Yesterday the Premier announced the carbon capture, utilization, and storage
challenge with up to $6M in funding for modelling, lab work, and engineering
related to getting to net zero carbon emissions by 2060. $3M is to support research
and development to advance CCUS and $3M to support studies of the feasibility of
NL's offshore to store locally and externally-produced carbon dioxide. Proposals
must be joint between industry and academia to promote cooperation and there
needs to be at least a 50% match for funding of projects.

Policy on Research Involving Indigenous Groups
A draft of Memorial's revised Research Involving Indigenous Groups policy is
available for review and to provide feedback from the university community.
Major revisions include

- alignment with the Tri-Council Policy on ethical conduct for research involving humans
- Clarifying the policy's principle and scope, the definition of Indigenous research, and a change in the title from Research Impacting Indigenous Groups.
- Replacing the term 'agreement in principle' to 'evidence of community engagement' to better reflect the relationship building intent of the policy.
- Emphasizing the importance of engagement with Indigenous communities during the concept development phase of the project
- Removing complexities and barriers

Feedback on the draft policy should be sent via email to the policy office by December 31. Would it be useful for the FoS to hold a meeting to discuss the draft policy? Maybe a special Faculty Council meeting with Dr. Adjei?

Questions Raised During Last Question Period
Terra Nova Young Innovator Award: Unbiased Data is a requirement of the granting agency, not the Faculty of Science or the VPR.

Student Travel: We have an amount of funding for student conferences that is obviously limited, and therefore, we need to distribute the funding among our undergraduate and graduate students who are presenting at conferences. The need to present at conferences is so that PIs can also contribute travel funding.

USRA/SURA applications: We have a finite number of USRA/SURA awards that are provided to students. Students can take their USRA awards wherever they like (i.e. medicine), and for SURAs, the award can be taken up with any supervisor in the FoS. We have been basing these awards on grades. It has always been that students from every department get awards and the numbers do not deviate that much from numbers of applications and numbers of majors. There was a concern as to whether EDI was considered when solely using grades to adjudicate these awards. I presume that would be for students who need to work etc. to pay for school etc.. Suzanne is looking into ways to try to account for that including asking students for a statement and to keep a seat or award for students who meet the requirements and who have special circumstances.

Teaching retreat funding: I believe that question was answered. The teaching retreat was very well attended, the presentations were on point and very interesting and the food, based a new partnership between MUN catering and an Indigenous chef, was delicious.

FSC 3038   **Research Week**
Presented by Jacqueline Blundell, Associate Dean of Graduate and Research

Research week is November 20-24. The Faculty of Science will be hosting 3MT (Three Minute Thesis) for graduate students on November 21st. If the departments

have any initiatives for Research week, please contact science@mun.ca. During Research Week there will be a special session called Research Exchange, which is an update on the types of grants that Faculty of Science have applied for and have been successful in obtaining. Whale of a Time will be held on November 24 from 5:00 – 7:00 pm in the Whale Atrium in the Core Science Building. Please RSVP your attendance to science@mun.ca.

FSC 3039   **Question Period:**

Ron Haynes asked to provide any information about a new computer machine room at OFI at Memorial, including the justification for this space. Travis Fridgen couldn't provide any information on this and will look into it.

FSC 3040   **Adjournment:**
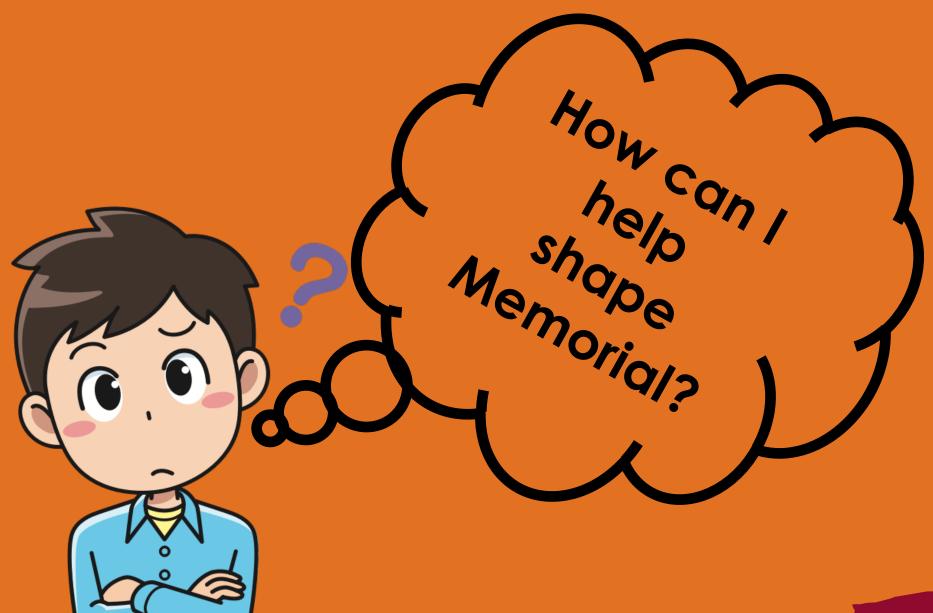Meeting adjourned at 2:00pm

Probably the biggest "What can I do?" question you should be asking yourself is:

So, I want to personally invite you to BE INVOLVED! with Memorial's, Senate & Senate Committees

MEMORIAL
UNIVERSITY

As an academic member of staff…

You'll help shape Memorial

Approximately 9 Senate seats currently vacant

wow!

www.mun.ca

MEMORIAL
UNIVERSITY

Responsibilities

Curriculum and Academic Policy matters

✓ **Admissions standards, courses of study and certificate/diploma/ degree qualifications**

✓ **General and faculty/school specific**

✓ **Examinations**

✓ **Conditions for awarding of scholarships, awards and prizes**

Convocation

✓ **Confer degrees/honorary degrees**

✓ **Award diplomas, certificates**

Academic Governance

MEMORIAL UNIVERSITY

Advice & Recommendations to the Board of Regents

Bicameralism: like many Canadian universities, Memorial University has a Senate that oversees academic affairs and the Board of Regents that oversees the management, administration and control of the property, revenue, business and affairs of Memorial University.

Senate may be asked to provide input to the Board of Regents on:

- Administrative policies that affect the teaching, learning, and research environments

Senate makes recommendations to the Board of Regents on:

- Establishment or termination of academic units
- Establishment of chairs, scholarships, fellowships, etc.
- Affiliation with other institutions
- Long-range strategic and campus plans

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MEMORIAL UNIVERSITY

Senate

Academic Unit Planning Committee (AUP)

Committee on Academic Appeals (SCAA)

Committee on Course Evaluation (SCCE)

Committee on Elections, Committees and By-Laws (SCECB)

Committee on Honorary Degrees and Ceremonial (SCHDC)

Senate Committee Research (SCoR)

Committee on Undergraduate Scholarships, Bursaries and Awards

Committee on Undergraduate Studies (SCUgS)

Executive Committee of Senate (Executive)

Grenfell Campus Committee on Special Admissions

Teaching and Learning Committee

University Committee on Admissions

University Planning and Budgeting Committee

MEMORIAL UNIVERSITY

Senate Committees [SCECB]

- Terms shall be for three years and shall be staggered so that one-third of the membership of each committee is replaced each year.

- ... normally, no academic staff member shall serve more than six consecutive years on any one Senate standing committee.

- ... normally, no academic staff member shall serve on more than two Senate standing committees at one time.

- ... an appropriate balance among constituencies... both male and female members, faculty from both junior and senior ranks, and members of target groups in accordance with the university's equity policies. ... at least one-third of each standing committee's membership shall be female and at least one-third shall be male.

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Who to ask?

Academic Unit Planning Committee (AUP) – Keith Matthews, keithm@mun.ca

Committee on Academic Appeals (SCAA) – senate@mun.ca

Committee on Course Evaluation (SCCE) – Sharon Pippy, spippy@mun.ca

Committee on Elections, Committees and By-Laws (SCECB) – senate@mun.ca

Committee on Honorary Degrees and Ceremonial (SCHDC) – senate@mun.ca

Committee on Undergraduate Scholarships, Bursaries and Awards – Tracey Wall, traceywall@mun.ca

Committee on Undergraduate Studies (SCUgS) – Jennifer Porter, scugs@mun.ca

Executive Committee of Senate (Executive) – senate@mun.ca

Grenfell Campus Committee on Special Admissions – Carolyn Parsons, csparsons@grenfell.mun.ca

Teaching and Learning Committee – vacant

University Committee on Admissions – Michelle Honeygold, mhoneygo@mun.ca

University Planning and Budgeting Committee - Keith Matthews, keithm@mun.ca

Senate Committee Research (SCoR) – David Miller, dmiller@mun.ca

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): *Cross-list existing BIOL 4911 with Ocean Sciences 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 4911 Applied Biology

REVISED COURSE NUMBER AND TITLE

OCSC 4911 - Applied Biology

ABBREVIATED COURSE TITLE

NA

RATIONALE

We propose a calendar change to cross-list BIOL 4911 with Ocean Sciences. This is a Harlow course and is taught back-to-back (directly after) the BIO L4910/OCSC 4923 – Vertebrate Diversity on Land and in the Sea during the spring semester. Cross-listing this course will give Ocean Science students the option to take this with the OCSC 4923 course. Students who study at the Harlow campus have to pay their own airfare and this can be quite costly for just one course. Adding the option of another OCSC course is not only more cost-effective for them, but also contributes to broadening their training in a significant way. At present, we do not offer our Ocean Sciences students any course where they can see scientists at work. This course will showcase the different career paths available to them with a BSc degree. The students learn through day trips to conservation areas, working farms, government labs, research hospitals, and universities. In the past students have remarked how the Harlow courses are the highlight of their university education. This requested cross-listing of BIOL 4911/OCSC 4911aligns with a Science-wide effort to add flexibility and experiential learning to programs. This approach also permits students from different departments to interact in an immersive environment, planting the seeds of interest in cross-disciplinary science research and education.

CALENDAR CHANGES
No changes as course is listed within the special topics block.

CALENDAR ENTRY AFTER CHANGES

SECONDARY CALENDAR CHANGES

No changes

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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From	Response Received
Grenfell campus	
Faculty of Business Administration	Yes, no concerns
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	
Department of Physics and Physical Oceanography	
Department of Psychology	
Marine Institute	
School of Human Kinetics and Recreation	
School of Medicine	Yes, no concerns
School of Nursing	
School of Pharmacy	Yes, no concerns
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

Thank you for the opportunity to provide feedback or concerns on the cross-listing proposal for BIOL4911. There are no concerns from the Faculty of Medicine.

Thanks, Danielle

DANIELLE O'KEEFE MD CCFP FCFP MSc | ACTING VICE DEAN, EDUCATION AND FACULTY AFFAIRS

Faculty of Medicine

Memorial University of Newfoundland|

Faculty of Medicine Building | Room M2M311

300 Prince Philip Drive
St. John's, NL, Canada   A1B 3V6
T 709 864 6289 | F 709 864 6336

WWW.MUN.CA/MEDICINE [1]

We see no impact for Business. We wish you the best with your proposal.

Erin

ERIN OLDFORD, PhD (she/her)
Associate Dean of Undergraduate Programs and Accreditation, Associate Professor of Finance, and Faculty Advisor to The Fund Faculty of Business Administration Memorial University of Newfoundland St. John's, Newfoundland & Labrador www.business.mun.ca

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Thank you for the opportunity to review this calendar change proposal.
Pharmacy has no concerns and this should not impact our students or programs.

Thanks,
Erin
--

Dr. Erin Davis BSc (Pharm), PharmD
Associate Dean Undergraduate Studies
Associate Professor
Memorial University School of Pharmacy
T 709 864 8815

E emdavis@mun.ca

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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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):
- X 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

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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

11.4.11 Co-operative Internship in Computer Science (CICS)

RATIONALE
The current regulation 11.4.11.1 wording regarding eligibility requirements for the Cooperative Internship in Computer Science (CICS) program is problematic for several reasons:

1. Students are able to rush through the required computer science courses so that they are eligible for the program at the end of their second year; however, the intention is for students to start the internship in their third year at the earliest.

2. Students can claim they are doing one of the computer science stream programs which have more specific course requirements thus allowing them to have computer science courses remaining after the internship is complete; then after the internship is finished they switch to the general computer science major and have no computer science courses remaining.

The proposed changes achieve the following:

- codifies the 75 credit hour minimum recommendation to prevent students from applying too early and hopefully discourages students from racing through their CS requirements to get an early "in" to the CICS

- prevents students from switching streams so they have 3CH of CS courses remaining to satisfy a stream which they have no intention of completing

- accommodates honours students who are often farther along in terms of CS courses completed than majors

The current regulation 11.4.11.3 wording references the ability for the internship project to be considered a component of the honours project however, this has not happened at least since 2009. We would like to remove this reference because it causes confusion for students. We are suggesting to remove the first sentence explicitly stating requirements must be satisfied for both the CICS and Honours program since this should be implied.

ANTICIPATED EFFECTIVE DATE
Fall 2024

CALENDAR CHANGES

11.4.11.1 Admission Requirements

In order to be considered for admission to the CICS, an applicant:

1.   must be a declared Computer Science Major;

2.   must be registered as a full-time student at the time of application;

3.   must have successfully completed Computer Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 and 6 credit hours at the 3000 level or beyond <u>prior to the start of the internship</u>;

4.   <u>must have completed at least 75 credit hours prior to the start of the internship;</u>

5.   must have at least 15 credit hours remaining after the co-operative internship in order to satisfy degree requirements, ~~3 credit hours of which must be in Computer Science;~~ <u>as described under</u> **Major in Computer Science** or **Honours in Computer Science**, <u>at least 3 credit hours of which must be in Computer Science courses. Course requirements specific to the programs in Data-Centric Computing, Smart Systems, or Visual Computing and Games are not considered if the student would otherwise satisfy the requirements for the Major in Computer Science or the Honours in Computer Science;</u> and

6.   is expected to return to University as a full-time student after the co-operative internship.

In addition to the above, admission is also subject to academic performance.

~~11.4.11.3 CICS and Honours Program~~

~~In case a student is enrolled in both the Honours program and the CICS, the requirements of both must be met. Upon approval from the honours project supervisor within the Department, the employer and the Head of the Department of Computer Science, an internship project may be submitted as a component of an honours project. These arrangements must be made within the first semester of the Internship placement.~~

CALENDAR ENTRY AFTER CHANGES

11.4.11.1 Admission Requirements

In order to be considered for admission to the CICS, an applicant:

1.   must be a declared Computer Science Major;

2.	must be registered as a full-time student at the time of application;

3.	must have successfully completed Computer Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 and 6 credit hours at the 3000 level or beyond prior to the start of the internship;

4.	must have completed at least 75 credit hours prior to the start of the internship;

5.	must have at least 15 credit hours remaining after the co-operative internship in order to satisfy degree requirements, as described under **Major in Computer Science** or **Honours in Computer Science,** at least 3 credit hours of which must be in Computer Science courses. Course requirements specific to the programs in Data-Centric Computing, Smart Systems, or Visual Computing and Games are not considered if the student would otherwise satisfy the requirements for the Major in Computer Science or the Honours in Computer Science; and

6.	is expected to return to University as a full-time student after the co-operative internship.

In addition to the above, admission is also subject to academic performance.

SECONDARY CALENDAR CHANGES
No secondary calendar changes

CONSULTATIONS SOUGHT

Academic Advising Centre
Humanities and Social Sciences – no concerns, suggested change to wording
Business Administration – see no impact
Education
Engineering and Applied Science – no concerns
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 – no concerns
Pharmacy – no concerns
Social Work
Science
• Biochemistry
• Biology
• Chemistry
• Earth Sciences
• Geography
• Mathematics and Statistics
• Ocean Sciences – no concerns
• Physics and Physical Oceanography
• Psychology – no concerns

LIBRARY REPORT

No additional requirements.

ENGINEERING

From: Engineering Consult <engrconsult@mun.ca>
Sent: Friday, October 20, 2023 8:07 AM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: Re: Calendar change proposal for review and feedback

Thank you for the opportunity to comment on the proposed Calendar
changes for Computer Science (minor, COMP 4304 and internship).   None
of these changes have any impact on our program.

Dr. Glyn George, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science Memorial University of Newfoundland
St. John's   NL   A1B 3X5

HSS

From: Dold, Patricia <pdold@mun.ca>
Sent: Tuesday, October 17, 2023 11:57 AM
To: cs-ugradadv@mun.ca
Subject: FW: Calendar change proposal for review and feedback

Good day,

HSS has no concerns with these proposals. I have one suggestion for the CICS proposal. I wonder if the language at 11.4.11.1.5 can be edited for clarity: Specific course requirements for stream programs <u>are not eligible/do not count toward the 15 remaining credit hours</u> if the student would otherwise . . ."

P Dold

Patricia Dold (she/her)

Associate Professor, Religious Studies

Associate Dean, Curriculum and Programs

Humanities and Social Sciences

NURSING

From: DeanNurse <DeanNurse@mun.ca>
Sent: Monday, October 16, 2023 11:40 AM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: RE: Calendar change proposal for review and feedback

Good morning Cathy.

Dr. April Pike, our interim dean at the Faculty of Nursing, tells me that she has reviewed the calendar change proposal and that nursing has no comments or concerns.

Thank you for your time, I hope you have a great day!

Jane

OCEAN SCIENCE

From: Iain J Mcgaw <ijmcgaw@mun.ca>
Sent: Friday, October 20, 2023 11:49 AM
To: cs-ugradadv@mun.ca
Subject: feedback on comp science programs

I have no concerns regarding the three changes to the programs Iain McGaw
--
****
Professor
Department of Ocean Sciences
0 Marine Lab Road
Memorial University

PHARMACY

From: Davis,Erin <emdavis@mun.ca>
Sent: Monday, October 23, 2023 2:53 PM

To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: FW: Calendar change proposal for review and feedback

Thank you for the opportunity to review the proposed changes. They should not impact pharmacy students or interns and so we have no concerns.

Erin

--

Dr. Erin Davis BSc (Pharm), PharmD

Associate Dean Undergraduate Studies

Associate Professor

Memorial University School of Pharmacy

PSYCHOLOGY

From: Psychology Deputy Head <psychdeputyhead@mun.ca>
Sent: Tuesday, October 24, 2023 11:30 AM
To: cs-ugradadv@mun.ca
Subject: RE: Calendar change proposal for review and feedback

Hi Cathy,

These changes all seem reasonable.

Best,

-Kathleen

Kathleen L. Hourihan, PhD (she/her)

Associate Professor

Deputy Head

Department of Psychology

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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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):
- X Amended or deleted program(s):
- ☐ New, amended or deleted Glossary of Terms Used in the Calendar entries
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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

11.4.10 Minor in Computer Science

RATIONALE

At present, minors can access all CS courses at the 2000-level and higher, and the number of minors we can admit into our program is tied to the need to ensure that there is space in all the 2000-level and higher courses for CS majors. Currently, minors are ranked along with majors (i.e. the same minimum average is required for admission) in order to ensure the minor program does not function as a back door to the major program. This means there are students from other programs who wish to complete a CS minor but are unable to because the program is so competitive. We would like to be able to admit far more students to the minor program than we are right now.

We are proposing to adjust the minor program to require COMP 2002 and COMP 2003 since these courses complete the core foundation of a CS program, demonstrating that students with this minor have solid all round skills and knowledge in CS. Further, these two courses, in particular COMP 2002, open the door to more choices of courses at the 3/4000 level; in fact the majority of courses at the 3/4000 level can be taken following these. At present COMP 2002 and COMP 2003 are optional courses for the minor so act as 'hidden' prerequisites for most of the 3/4000 level courses that minors want to take, which is not ideal.

Requiring two courses to be taken at the 3/4000 level provides more gravitas to the minor. We consulted with other units about which CS courses they felt would benefit minors, and whilst there was naturally diversity in the replies, a common aspect was that they often identified two courses as beneficial. So we propose to require minors take two 3/4000 level courses as they see fit best with their interests. To accommodate that capability we propose to remove the ability for minors to take COMP2004/5/6/7/8, which are intended to provide breadth to the major program only. Removal of those courses from the minor electives will also act as a gatekeeper to prevent the minor becoming a back door to the CS program, allowing the opportunity to separate the admissions processes with a view to accommodating more students into a minor program where resources allow.

The proposed program changes will remove some choice of courses at the lower level but give it back at the higher level, where there is more variety. Reducing choice at the lower level would allow us to admit many more minors than we do at present, by targeting our resources at those courses to guarantee them progress.

ANTICIPATED EFFECTIVE DATE
September 2024

CALENDAR CHANGES

11.4.10 Minor in Computer Science

For a Minor in Computer Science, a student must complete at least 24 credit hours in Computer Science courses, including:

1. Computer Science 1001, 1002, 1003, 2001, 2002, 2003.

2. ~~At least 6 credit hours selected from Computer Science 2002, 2003, 2004, 2005, 2006, 2007, 2008.~~ 6 credit hours in Computer Science at the 3000 level or higher.

3. ~~Three additional credit hours at the 3000 level or above.~~

4. ~~Additional courses as necessary, at the 2000 level or above, to fulfill the requirement for 24 credit hours in Computer Science.~~

CALENDAR ENTRY AFTER CHANGES

11.4.10 Minor in Computer Science

For a Minor in Computer Science, a student must complete at least 24 credit hours in Computer Science courses, including:

1. Computer Science 1001, 1002, 1003, 2001, 2002, 2003.

2. 6 credit hours in Computer Science at the 3000 level or higher.

CONSULTATIONS SOUGHT

Academic Advising Centre
Humanities and Social Sciences – no concerns
Business Administration – welcome change since easier access to minor for Business students
Education
Engineering and Applied Science – no concerns
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 – no concerns
Pharmacy – no concerns
Social Work
Science
• Biochemistry
• Biology
• Chemistry
• Earth Sciences
• Geography
• Mathematics and Statistics
• Ocean Sciences – no concerns
• Physics and Physical Oceanography
• Psychology – no concerns

BUSINESS

From: Oldford, Erin <eoldford@mun.ca>
Sent: Monday, October 16, 2023 10:47 AM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: FW: Calendar change proposal for review and feedback

Hi Cathy,

Thank you for the opportunity to review.

We see no direct impact on Business. We do welcome the change, as it allows our students to more easily access the minor and increases flexibility in the upper year courses.

Erin

Erin Oldford, PhD

Associate Dean of Undergraduate Programs and Accreditation

Associate Professor of Finance

Faculty of Business Administration

Memorial University

ENGINEERING

From: Engineering Consult <engrconsult@mun.ca>
Sent: Friday, October 20, 2023 8:07 AM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: Re: Calendar change proposal for review and feedback

Thank you for the opportunity to comment on the proposed Calendar changes for Computer Science (minor, COMP 4304 and internship). None of these changes have any impact on our program.

Dr. Glyn George, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science Memorial University of Newfoundland
St. John's   NL   A1B 3X5

HSS

From: Dold, Patricia <pdold@mun.ca>
Sent: Tuesday, October 17, 2023 11:57 AM
To: cs-ugradadv@mun.ca
Subject: FW: Calendar change proposal for review and feedback

Good day,

HSS has no concerns with these proposals. I have one suggestion for the CICS proposal. I wonder if the language at 11.4.11.1.5 can be edited for clarity: Specific course requirements for stream programs <u>are not eligible/do not count toward the 15 remaining credit hours</u> if the student would otherwise . . ."

P Dold

Patricia Dold (she/her)

Associate Professor, Religious Studies

Associate Dean, Curriculum and Programs

Humanities and Social Sciences

NURSING

From: DeanNurse <DeanNurse@mun.ca>
Sent: Monday, October 16, 2023 11:40 AM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: RE: Calendar change proposal for review and feedback

Good morning Cathy.

Dr. April Pike, our interim dean at the Faculty of Nursing, tells me that she has reviewed the calendar change proposal and that nursing has no comments or concerns.

Thank you for your time, I hope you have a great day!

Jane

OCEAN SCIENCE

From: Iain J Mcgaw <ijmcgaw@mun.ca>
Sent: Friday, October 20, 2023 11:49 AM
To: cs-ugradadv@mun.ca
Subject: feedback on comp science programs

I have no concerns regarding the three changes to the programs Iain McGaw
--
****
Professor
Department of Ocean Sciences
0 Marine Lab Road
Memorial University

PHARMACY

From: Davis,Erin <emdavis@mun.ca>
Sent: Monday, October 23, 2023 2:53 PM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: FW: Calendar change proposal for review and feedback

Thank you for the opportunity to review the proposed changes. They should not impact pharmacy students or interns and so we have no concerns.

Erin

--

Dr. Erin Davis BSc (Pharm), PharmD

Associate Dean Undergraduate Studies

Associate Professor

Memorial University School of Pharmacy

PSYCHOLOGY

From: Psychology Deputy Head <psychdeputyhead@mun.ca>
Sent: Tuesday, October 24, 2023 11:30 AM
To: cs-ugradadv@mun.ca
Subject: RE: Calendar change proposal for review and feedback

Hi Cathy,

These changes all seem reasonable.

Best,

-Kathleen

Kathleen L. Hourihan, PhD (she/her)

Associate Professor

Deputy Head

Department of Psychology

LIBRARY REPORT
No additional requirements.

RESOURCE IMPLICATIONS

If we decide to increase admission to the minor program, it could involve a request for additional resources associated with opening a new lab section of COMP 2001/2/3. This will depend on the instructional resources needed to serve the demand for the major program.

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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LIST OF CHANGES

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

- ☐ New course
- X Amended or deleted course(s): COMP 2001, 2002, 2003
- ☐ 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

2003 Computer Architecture

RATIONALE

Right now the CS majors courses are reserved for students who have been admitted into one of the CS majors programs, the CS minor program or the computational chemistry program. This means that students admitted in these programs have the first chance to register, if there is space remaining in courses after a reserved period of time then any student can register.

This has resulted in a situation for many students where they do not have high enough grades to gain admission to one of the programs but they are able to enroll in some CS majors courses (when there is space). As a result, many students have a false sense of hope that they will eventually be able to complete one of the programs. This leads to these students repeatedly trying to take courses and electives that they do not need just so they can remain a full-time student, and it causes stress for these student when they continually are unable to enroll in CS courses.

The proposed change will mean that future students will only be able to take CS majors courses if they have been admitted into one of the CS majors programs, the CS minor program or the computational chemistry program. We are choosing to restrict only 2001/2/3 rather than all our majors courses so that students who have been able to enroll in courses up to or beyond 2001/2/3 still have an opportunity to try and complete the program requirements.

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, COMP 1003, ~~and~~ Mathematics 1000; and acceptance into a major, minor or honours program in Computer Science or Computational Chemistry

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 acceptance into a major, minor or honours program in Computer Science or Computational Chemistry

2003 Computer Architecture introduces computer architecture at the digital logic implementation level, at the instruction set level, and at the level where programming languages are translated into the underlying machine instructions.

> CR: the former COMP 3724
> LH: 3
> PR: COMP 1001, COMP 1002 or Mathematics 2320, ~~and~~ COMP 1003; and acceptance into a major, minor or honours program in Computer Science or Computational Chemistry

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, COMP 1003, Mathematics 1000; and acceptance into a major, minor or honours program in Computer Science or Computational Chemistry

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 acceptance into a major, minor or honours program in Computer Science or Computational Chemistry

2003 Computer Architecture introduces computer architecture at the digital logic implementation level, at the instruction set level, and at the level where programming languages are translated into the underlying machine instructions.

> CR: the former COMP 3724
> LH: 3
> PR: COMP 1001, COMP 1002 or Mathematics 2320, COMP 1003; and acceptance into a major, minor or honours program in Computer Science or Computational Chemistry

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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CONSULTATIONS SOUGHT

Academic Advising Centre
Humanities and Social Sciences
Business Administration – no concerns
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 – no concerns
Pharmacy – no concerns
Social Work
Science
• Biochemistry
• Biology
• Chemistry
• Earth Sciences – no concerns, suggested revisit restriction in future
• Geography
• Mathematics and Statistics
• Ocean Sciences – no concerns

> - Physics and Physical Oceanography – no concerns, sought clarification

BUSINESS

From: Oldford, Erin <eoldford@mun.ca>
Sent: Thursday, September 21, 2023 12:29 PM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: RE: Calendar change proposal for review and feedback

Hi Cathy,

Thank you for sharing and for the opportunity to provide feedback.

We don't see any direct impact on this for Business. It may just mean some courses our students might have taken as electives will not be available as electives for them anymore.

Best,

Erin

EARTH SCIENCE

From: J. Kim Welford <kwelford@mun.ca>
Sent: Tuesday, September 26, 2023 10:18 PM
To: cs-ugradadv@mun.ca
Cc: Miskell, Michelle <mmiskell@mun.ca>
Subject: Re: Calendar change proposal for review and feedback

Hi Cathy,

Within the Geophysics group in the Earth Sciences department, we have had a look at the proposed calendar changes for COMP 2001, 2002, and 2003.

There is no great concern with these changes but just looking ahead, if a joint geophysics-comp sci degree ever materializes (currently under discussion), then the language in the calendar changes would have to reflect the existence of such a joint program. It was also suggested that there should be a

consideration to revisit these restrictions every few years to see if the pressure on CS eases over time and the classes could be opened up to others.

All the best,

KIM…

NURSING

From: DeanNurse <DeanNurse@mun.ca>
Sent: Sunday, September 17, 2023 9:36 PM
To: cs-ugradadv@mun.ca
Subject: FW: Calendar change proposal for review and feedback

Good evening.

Our interim dean at the Faculty of Nursing, Dr. April Pike, tells me that MUNFON has no concerns or comments regarding the calendar change below and attached.

Thank you for your time, I hope you have a great day!
Jane

OCEAN SCIENCE

-----Original Message-----
From: Iain J Mcgaw <ijmcgaw@mun.ca>
Sent: Tuesday, September 19, 2023 2:13 PM
To:

Looks good to me
No further comments
Iain McGaw

PHARMACY

From: Davis,Erin <emdavis@mun.ca>
Sent: Friday, September 15, 2023 2:25 PM

To: cs-ugradadv@mun.ca
Subject: Calendar change proposal for review and feedback

Hi Cathy,

This change should not impact pharmacy students or programs and we therefore have no concerns. Thank you for the opportunity to review and comment on the proposed change!

Erin

--

Erin Davis, BSc(Pharm), PharmD

Associate Professor | School of Pharmacy

Associate Dean, Undergraduate | School of Pharmacy

Chair, Committee on Undergraduate Studies | School of Pharmacy

Clinical Assistant Professor | Faculty of Medicine, Discipline of Family Medicine

PHYSICS

From: Miskell, Michelle <mmiskell@mun.ca>
Sent: Monday, September 25, 2023 12:50 PM
To: Hyde, Cathy <cathy@mun.ca>
Cc: Ivan Saika-Voivod <saika@mun.ca>; pmorill@mun.ca
Subject: RE: Calendar change proposal for review and feedback - COMP 2001/2002/2003

Hi Cathy,

Thanks for sending this proposal around for consultation.

For Earth Sciences, our Deputy Head has sent it to one of the geophysics profs, so you may or may not hear back from them with any concerns. I don't have any myself.

For Physics, I note that there are joint major and joint honours degrees that include these courses. I assume that students in these joint programs will still have access to register for these courses?

Thank you very much!
Michelle

Ms. Michelle Miskell (pronouns: she/her)

Manager of Academic Programs, Department of Earth Sciences, ER 4063

Academic Program Officer, Dept of Physics and Physical Oceanography, C 3004

LIBRARY REPORT
No additional requirements.

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LIST OF CHANGES

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

- **X** New course:
- ☐ 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
COMP3019: Security and Privacy in Computer Systems

ABBREVIATED COURSE TITLE
Sec Priv in Comp Sys

RATIONALE
For the past few years we have offered a popular special topics course in cyber security (COMP 4820). This is a proposal for a new 3000-level course in cyber security, as the first of two courses that students can elect to take in this field. This course will provide students with basic knowledge and skills in security and privacy principles, practices, regulations, and tools. Students will be able to take those skills to the workforce, in-line with the objective of increasing the number of computer science graduates that will work in the technology sector, particularly in roles involving cyber security.

ANTICIPATED EFFECTIVE DATE
September 2024

CALENDAR CHANGES
3019 Security and Privacy in Computer Systems covers the basic principles and tools needed to design and develop secure general computer software and websites. These include regulations and other non-technical aspects of security and privacy, as well as secure practices in developing software. The knowledge, skills, and tools learned will prepare the learner to design and develop software and websites without common security vulnerabilities and to be able to protect themselves and their team from basic attacks.

Prerequisites: COMP 2004, 2005

CALENDAR ENTRY AFTER CHANGES
3019 Security and Privacy in Computer Systems covers the basic principles and tools needed to design and develop secure general computer software and websites. These

include regulations and other non-technical aspects of security and privacy, as well as secure practices in developing software. The knowledge, skills, and tools learned will prepare the learner to design and develop software and websites without common security vulnerabilities and to be able to protect themselves and their team from basic attacks.

Prerequisites: COMP 2004, 2005

SECONDARY CALENDAR CHANGES

11.4.5 Major in Computer Science (Data-centric Computing) (B.Sc. only)

As a component of the Degree Regulations for the General Degree of Bachelor of Science a student must successfully complete the following courses:

1. Forty-five credit hours in Computer Science courses are required for a major in Computer Science (Data-centric Computing):

   a. Computer
      Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, and 2008;

   b. Computer Science 3202, 3400, 3401 and 4304; and

   c. Six additional credit hours in Computer Science courses selected from Computer Science 3019, 4550, 4734, 4750, 4754, 4820 4019. Some of these courses require the completion of prerequisites that are not themselves part of the major.

2. Additional courses required are: Mathematics 1000, 1001, 2000, 2050, and Statistics 2500 or 2550.

It is recommended, but not required, that students take Business 4720.

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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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
• Biochemistry
• Biology
• Chemistry
• Earth Sciences
• Geography
• Mathematics and Statistics
• Ocean Sciences
• Physics and Physical Oceanography

LIBRARY REPORT
Textbooks proposed for the course.

RESOURCE IMPLICATIONS
Teaching resources for this course exist in the Computer Science department.

ADDITIONAL INFORMATION REQUIRED FOR NEW COURSE PROPOSALS

Proposed Course Outline

Introduction to basics of Security and privacy (3 hours)
Security Principles and systematic approach to Security (4 hours)
Non-technical aspects of Security and Privacy (4 hours)
Privacy regulations in Canada and the world (3 hours)
Software Security and Secure Software Development and website security (12 hours)
Access Control and Authentication (5 hours)
Host Hardening (5 hours)

Proposed Evaluation Scheme:

Assignments 40%
Labs 30%
Exam 30%

Proposed Textbooks:
- Building Secure and Reliable Systems: Best Practices for Designing, Implementing, and Maintaining Systems, 2020, Adkins et al.
- Security in Computing, 5th Ed. 2015, Pfleeger, Pfleeger, and Margulies
- Building Secure Software: How to Avoid Security Problems the Right Way, John Viega, Gary McGraw, 2001

Instructor:
Navid Nasr Esfahani

Memorial University of Newfoundland
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LIST OF CHANGES

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

- **X** New course:
- ☐ 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
COMP 3730 – Introduction to Parallel Programming

ABBREVIATED COURSE TITLE
Intro to Parallel Prog

RATIONALE
Multi-threaded programming has become ubiquitous on modern computing systems. Nearly all processors contain multiple computing cores, since the performance of an individual processor has reached peak performance. This architecture-level parallelism is expected to increase in future. Programming for multi-core CPUs or GPUs requires specialized techniques to handle multiple concurrent threads of execution. Currently, there is no undergraduate course in Computer Science that is focused on parallel programming.

CALENDAR CHANGES
3730 Introduction to Parallel Programming considers the fundamental aspects of programming for parallel architectures. Almost all modern computers contain multiple processing units, since individual processors have effectively reached peak performance. This course will focus on the considerations and challenges of writing parallel programs, particularly for multicore processors and graphics processing units. Topics will include threaded programming, vectorization, parallel design patterns, synchronization and workload balancing, high-performance computing, remote procedure calls, detecting failures, and cloud systems.
CR: ECE 7400
PR: COMP 2001, COMP 2004

CALENDAR ENTRY AFTER CHANGES
3730 Introduction to Parallel Programming considers the fundamental aspects of programming for parallel architectures. Almost all modern computers contain multiple processing units, since individual processors have effectively reached peak performance. This course will focus on the considerations and challenges of writing parallel programs, particularly for multicore processors and graphics processing units. Topics will include threaded programming, vectorization, parallel design patterns, synchronization and workload balancing, high-performance computing, remote procedure calls, detecting failures, and cloud systems.
CR: ECE 7400
PR: COMP 2001, COMP 2004

SECONDARY CALENDAR CHANGES

ECE 7400 Concurrent Programming surveys parallel and distributed architectures and examines patterns of concurrent program design; correctness of concurrent programs: safety and liveness properties, proof of properties; synchronization using locks, semaphores, and monitors; communication using message passing and remote procedures; parallelization for high-performance computation and advanced topics such as scientific applications, distributed systems, model checking, and transaction processing.

CR: the former ENGI 8893, COMP 3730
EQ: the former ENGI 7894
PR: ECE 5400 or the former ENGI 5892 or the former ENGI 6892

SECONDARY CALENDAR ENTRY AFTER CHANGES:

ECE 7400 Concurrent Programming surveys parallel and distributed architectures and examines patterns of concurrent program design; correctness of concurrent programs: safety and liveness properties, proof of properties; synchronization using locks, semaphores, and monitors; communication using message passing and remote procedures; parallelization for high-performance computation and advanced topics such as scientific applications, distributed systems, model checking, and transaction processing.

CR: the former ENGI 8893, COMP 3730
EQ: the former ENGI 7894
PR: ECE 5400 or the former ENGI 5892 or the former ENGI 6892

LIBRARY REPORT
No additional requirements.

RESOURCE IMPLICATIONS
This course will be taught by a faculty member with expertise in parallel programming. There are no resource implications.

ADDITIONAL INFORMATION REQUIRED FOR NEW COURSE PROPOSALS

COMP 3730 – Introduction to Parallel Programming

Course Outline:

- Introduction (1 hour)
  - "Why parallel?", concurrent vs parallel programming, Moore's Law
- Types of parallelism (1 hour)
  - task, data, instruction and thread-level parallelism, Flynn's taxonomy
- Shared-memory programming (2 hours)
  - Threaded programming, explicit and implicit thread control, trivially parallel algorithms
- Explicit threading (4 hours)
- Synchronization (2 hours)
  - race conditions, mutual exclusion, deadlocks, livelocks, starvation, atomicity
- Synchronization design patterns (3 hours)
  - divide and conquer, locks, critical sections, semaphores
- Work sharing and load balancing (3 hours)
  - data distribution, interleaving, task distribution, task time estimation
- Performance and scaling (2 hours)
  - efficiency, speedup, Amdahl's Law, weak scaling, strong scaling, compute vs memory bound computation
- Implicit threading (4 hours)
  - OpenMP
- Memory hierarchy (2 hours)
  - cache coherency, memory optimization, multi-core processors, hyper-threading
- Vectorization (3 hours)
  - single instruction, multiple data, AVX instruction set
- Graphics processing units (2 hours)
  - GPU architecture, memory hierarchy

- CUDA (4 hours)
  - data transfer, threads, blocks, single instruction multiple thread

Proposed Evaluation Scheme:
- Assignments (4) – 50%
- Midterm examination (written) – 20%
- Final examination (written) – 30%

Textbooks:
- J.L. Hennessey & D.A. Patterson, *Computer Architecture: a Quantitative Approach*, 5th Edition, Morgan Kaufmann, 2011.
- C. Lin & L. Snyder, *Principles of Parallel Programming*, Pearson, 2009.
- D.B. Kirk & W.H. Wen-Mei, *Programming Massively Parallel Processors*, Morgan Kaufmann, 2016.

Instructor:
Dr. Terrence Tricco

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 – want to credit restrict with EN 7400
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 – no concerns
Pharmacy – no concerns
Social Work
Science
- Biochemistry   - Biology   - Chemistry   - Earth Sciences   - Geography   - Mathematics and Statistics   - Ocean Sciences

> • Physics and Physical Oceanography

ENGINEERING

-----Original Message-----
From: Engineering Consult <engrconsult@mun.ca>
Sent: Wednesday, March 15, 2023 9:17 AM
To: Hyde, Cathy <cathy@mun.ca>
Subject: Re: Proposal for new computer science parallel programming course

Dear Cathy,
My sincere apology for the delay in replying. We discussed this in our CUGS meeting and support this change to credit restrict ECE 7400 for COMP 3730 – Introduction to Parallel Programming.

We recommend that a secondary calendar change be requested by the Computer Science department to credit restrict COMP 3730 for ECE 7400.

If you have any question, please feel free to let us know.
Thanks,
Salim

Dr. Salim Ahmed, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science Memorial University of Newfoundland
St. John's   NL   A1B 3X5

PHARMACY

From: Davis,Erin <emdavis@mun.ca>
Sent: Friday, June 2, 2023 2:32 PM
To: cs-ugradadv@mun.ca
Subject: FW: Consultation on Calendar changes - Computer Science new courses

Hello,

Thank you for the opportunity to comment on the two new proposed courses for computer science. Pharmacy has no concerns and we do not believe this will impact our students or programs.

Thank you,

Erin

--

Dr. Erin Davis BSc (Pharm), PharmD

Associate Dean Undergraduate Studies

Associate Professor

Memorial University School of Pharmacy

T 709 864 8815

E emdavis@mun.ca

NURSING

From: DeanNurse <DeanNurse@mun.ca>
Sent: Friday, June 2, 2023 3:11 PM
To: cs-ugradadv@mun.ca
Subject: FW: Consultation on Calendar changes - Computer Science new courses

Good afternoon.

The Faculty of Nursing sees no implications for Nursing with these course proposals.

Thank you for your time,

Jane

On behalf of Dr. April Pike, interim dean, Faculty of Nursing

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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LIST OF CHANGES

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

- **X** New course:
- ☐ 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
COMP3766 – Introduction to Robotic Manipulation

ABBREVIATED COURSE TITLE
Intro to Robot Manip

RATIONALE
The insertion of automation technologies from industries into our daily lives has grown over the decades. A considerable number of tasks are already automated, and the insertion of robotic manipulation is expected to increase in the future. However, developing new robotics systems and automation for a growing industry requires specialized techniques. Existing courses explore algorithmic techniques for AI and autonomous mobile robotic hardware. This course focuses on introducing and exploring the basics of robotics from the manipulation perspective through modelling and simulation while developing applications and learning how to apply AI methods.

CALENDAR CHANGES
3766 **Introduction to Robotic Manipulation** will provide an introduction to mathematical formulation and practical aspects of robotic manipulators. It will present kinematics, dynamics, control and programming vital to the effective use of robotic arms. Moreover, a complete yet straightforward robotic manipulator model will be developed to demonstrate these concepts with the help of high-level languages and frameworks. The course will also address robotics sensing, perception, and Artificial Intelligence topics applied to robotic manipulation.
LH: three 3-hour sessions per semester
PR: COMP2001 and COMP2002, MATH2000 and MATH2050, and STAT2500 or STAT2550

CALENDAR ENTRY AFTER CHANGES
3766 **Introduction to Robotic Manipulation** will provide an introduction to mathematical formulation and practical aspects of robotic manipulators. It will present kinematics, dynamics, control and programming vital to the effective use of robotic arms. Moreover, a complete yet straightforward robotic manipulator model will be developed to demonstrate these concepts with the help of high-level languages and frameworks. The course will also address robotics sensing, perception, and Artificial Intelligence topics applied to robotic manipulation.
LH: three 3-hour sessions per semester
PR: COMP2001 and COMP2002, MATH2000 and MATH2050, and STAT2500 or STAT2550

LIBRARY REPORT
No additional requirements.

RESOURCE IMPLICATIONS
This course will be taught by a faculty member with expertise in robotic manipulation. There are no resource implications.

ADDITIONAL INFORMATION REQUIRED FOR NEW COURSE PROPOSALS

COMP 3766 – Introduction to Robotic Manipulation

Course Outline:
Introduction and mathematical background (1 week).
Direct and Inverse Kinematics (2 weeks).
Robot dynamics and force control (2 weeks).
Path and trajectory planning (2 weeks).
Sensors and perception (2 weeks).
Vision systems (1 week).
Fuzzy logic (1 week).
Manipulation and AI (2 weeks).

Proposed Evaluation Scheme:
Quizzes (2)   20%
Labs exercises (3)   10%
Assignments (6)   40%
Final exam   30%
                     100%

Textbooks:
> "Robotics: Modelling, Planning and Control," By Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, 2009 (Springer London).
> Online notes and slides will also be available.

Other Reference Texts:
> "Introduction to Robotics: Mechanics and Control," By John J. Craig, 2004 (Pearson; 3rd edition).
> "Robots Manipulators: Mathematics, Programming and Control," By Richard P. Paul, 1981 (MIT Press).

Instructor:
Dr. Vinicius Prado da Fonseca

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 – no concerns
Pharmacy – no concerns
Social Work
Science
● Biochemistry ● Biology ● Chemistry ● Earth Sciences ● Geography ● Mathematics and Statistics ● Ocean Sciences ● Physics and Physical Oceanography

PHARMACY

From: Davis,Erin <emdavis@mun.ca>
Sent: Friday, June 2, 2023 2:32 PM
To: cs-ugradadv@mun.ca
Subject: FW: Consultation on Calendar changes - Computer Science new courses

Hello,

Thank you for the opportunity to comment on the two new proposed courses for computer science. Pharmacy has no concerns and we do not believe this will impact our students or programs.

Thank you,

Erin

--

Dr. Erin Davis BSc (Pharm), PharmD

Associate Dean Undergraduate Studies

Associate Professor

Memorial University School of Pharmacy

T 709 864 8815

E emdavis@mun.ca

NURSING

From: DeanNurse <DeanNurse@mun.ca>
Sent: Friday, June 2, 2023 3:11 PM
To: cs-ugradadv@mun.ca
Subject: FW: Consultation on Calendar changes - Computer Science new courses

Good afternoon.

The Faculty of Nursing sees no implications for Nursing with these course proposals.

Thank you for your time,

Jane

On behalf of Dr. April Pike, interim dean, Faculty of Nursing

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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LIST OF CHANGES

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☐ 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
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☐ 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
COMP4019: Secure system design

ABBREVIATED COURSE TITLE
Secure Sys Design

RATIONALE
For the past few years we have offered a popular special topics course in cyber security (COMP 4820). This is a proposal for a new 4000-level course in cyber security, as the second of two courses that students can elect to take in this field. This course is intended for an advanced audience with a background in studying security, and therefore takes the other proposed new course (COMP 3019) as its prerequisite. This course provides students with further valuable skills they can take to the workforce, in-line with the objective of increasing the number of computer science graduates that will work in the technology sector, particularly in roles involving cyber security.

ANTICIPATED EFFECTIVE DATE
September 2024

CALENDAR CHANGES
<u>4019 Secure System Design covers the theory and secure practices of using cryptography in computer systems, advanced common attacks on software and websites, security and privacy on cloud, over networks, on databases, and in machine learning. Finally, it introduces active defence, penetration testing, and forensics. The knowledge, skills, and tools learned will prepare the learner to design, develop, analyze, test, and maintain a system with non-generic security and privacy requirements.</u>

<u>CR: COMP 4820</u>
<u>LH: 2</u>
<u>PR: COMP 3019, 3600</u>

CALENDAR ENTRY AFTER CHANGES
4019 Secure System Design covers the theory and secure practices of using cryptography in computer systems, advanced common attacks on software and websites, security and privacy on cloud, over networks, on databases, and in machine

learning. Finally, it introduces active defence, penetration testing, and forensics. The knowledge, skills, and tools learned will prepare the learner to design, develop, analyze, test, and maintain a system with non-generic security and privacy requirements.

CR: COMP 4820
LH: 2
PR: COMP 3019, 3600

SECONDARY CALENDAR CHANGES

11.4.5 Major in Computer Science (Data-centric Computing) (B.Sc. only)

As a component of the Degree Regulations for the General Degree of Bachelor of Science a student must successfully complete the following courses:

1. Forty-five credit hours in Computer Science courses are required for a major in Computer Science (Data-centric Computing):

    a. Computer
       Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, and 2008;

    b. Computer Science 3202, 3400, 3401 and 4304; and

    c. Six additional credit hours in Computer Science courses selected from Computer Science 3019, 4550, 4734, 4750, 4754, 4820 4019. Some of these courses require the completion of prerequisites that are not themselves part of the major.

2. Additional courses required are: Mathematics 1000, 1001, 2000, 2050, and Statistics 2500 or 2550.

It is recommended, but not required, that students take Business 4720.

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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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
• Biochemistry • Biology • Chemistry • Earth Sciences • Geography • Mathematics and Statistics • Ocean Sciences • Physics and Physical Oceanography

LIBRARY REPORT
Textbooks proposed for the course.

RESOURCE IMPLICATIONS
Teaching resources for this course exist in the Computer Science department.

ADDITIONAL INFORMATION REQUIRED FOR NEW COURSE PROPOSALS

Representative Course Outline

Cryptography (8 hours)
Advanced Software Security and Secure Software Development (4 hours)
Security and Privacy on Cloud (3 hours)
Security and Privacy over Networks (6 hours)
Database Security (5 hours)
Security and Privacy in Machine Learning (6 hours)
Active defence and forensics (4 hours)

Representative Method of Evaluation

Self-assessment 5%
Assignments 30%
Labs 20%
Project 25%
Exam 20%

Proposed Textbooks:
- Computer Security and the Internet: Tools and Jewels from Malware to Bitcoin, 2nd Ed. by van Oorschot, 2021
- Cryptography, Theory and Practice, 4th Ed. by Stinson and Paterson, 2018

Instructor:
Navid Nasr Esfahani

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
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LIST OF CHANGES

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- ☐ Other:

ADMINISTRATIVE AUTHORIZATION

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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
COMP 4304: Data Visualization

RATIONALE
With the current prerequisites students ranging from second to fourth year are able to take this course. The few second year students who take the course usually lack sufficient background in data preparation techniques, so the instructor must spend the first two weeks of the course teaching that background. Conversely the majority of students who take COMP 4304 are third and fourth year students, and most of those are already familiar with these topics and tools because of other courses already completed at the 3000 level. So for most students this two week period at the start is unnecessary.

The three other 3000 level courses that provide sufficient background to cover the gap and therefore act as an excellent primer for COMP 4304 are:
- COMP 3200 Algorithm Techniques for Artificial Intelligence
- COMP 3400 Data Preparation Techniques, and
- COMP 3401 Introduction to Data Mining.

Of these three, COMP 3400 is the most natural predecessor, and we already recommend to students they take that course ahead of COMP 4304. However the other two courses suffice to act as prerequisite, so we intend to provide students with the choice. Adding this prerequisite will allow more time to go deeper into data visualization topics in COMP 4304.

ANTICIPATED EFFECTIVE DATE
September 2024

CALENDAR CHANGES

COMP 4304 Data Visualization covers interactive representation of data using a modern programming library. Topics include an introduction to the software platform and the principles for data selection, analysis, design and creation of dynamic visualizations. Students produce interactive web-based objects, addressing problems in the presentation and understanding of large data collections. The techniques discussed are applicable to different sources and types of data.

CR: the former COMP 4767
PR: COMP 2001 or the former COMP 2710, COMP 2002 or the former COMP 2711; one of COMP 3200, COMP 3400 or COMP 3401; and one of Statistics 2500 or Statistics 2550

CALENDAR ENTRY AFTER CHANGES

COMP 4304 Data Visualization covers interactive representation of data using a modern programming library. Topics include an introduction to the software platform and the principles for data selection, analysis, design and creation of dynamic visualizations. Students produce interactive web-based objects, addressing problems in the presentation and understanding of large data collections. The techniques discussed are applicable to different sources and types of data.

CR: the former COMP 4767
PR: COMP 2001 or the former COMP 2710, COMP 2002 or the former COMP 2711; one of COMP 3200, COMP 3400 or COMP3401; and one of Statistics 2500 or Statistics 2550

CONSULTATIONS SOUGHT

Academic Advising Centre
Humanities and Social Sciences – no concerns
Business Administration – no impact
Education
Engineering and Applied Science – no concerns
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 – no concerns
Pharmacy – no concerns
Social Work
Science
• Biochemistry • Biology • Chemistry • Earth Sciences • Geography • Mathematics and Statistics • Ocean Sciences – no concerns • Physics and Physical Oceanography • Psychology – no concerns

LIBRARY REPORT
No additional requirements.

ENGINEERING

From: Engineering Consult <engrconsult@mun.ca>
Sent: Friday, October 20, 2023 8:07 AM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: Re: Calendar change proposal for review and feedback

Thank you for the opportunity to comment on the proposed Calendar
changes for Computer Science (minor, COMP 4304 and internship).   None
of these changes have any impact on our program.

Dr. Glyn George, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science Memorial University of Newfoundland
St. John's   NL   A1B 3X5

HSS

From: Dold, Patricia <pdold@mun.ca>
Sent: Tuesday, October 17, 2023 11:57 AM
To: cs-ugradadv@mun.ca
Subject: FW: Calendar change proposal for review and feedback

Good day,

HSS has no concerns with these proposals. I have one suggestion for the CICS proposal. I wonder if the language at 11.4.11.1.5 can be edited for clarity: Specific course requirements for stream programs <u>are not eligible/do not count toward the 15 remaining credit hours</u> if the student would otherwise . . ."

P Dold

Patricia Dold (she/her)

Associate Professor, Religious Studies

Associate Dean, Curriculum and Programs

Humanities and Social Sciences

NURSING

From: DeanNurse <DeanNurse@mun.ca>
Sent: Monday, October 16, 2023 11:40 AM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: RE: Calendar change proposal for review and feedback

Good morning Cathy.

Dr. April Pike, our interim dean at the Faculty of Nursing, tells me that she has reviewed the calendar change proposal and that nursing has no comments or concerns.

Thank you for your time, I hope you have a great day!

Jane

OCEAN SCIENCE

From: Iain J Mcgaw <ijmcgaw@mun.ca>
Sent: Friday, October 20, 2023 11:49 AM
To: cs-ugradadv@mun.ca
Subject: feedback on comp science programs

I have no concerns regarding the three changes to the programs Iain McGaw
--
****
Professor
Department of Ocean Sciences
0 Marine Lab Road
Memorial University

PHARMACY

From: Davis,Erin <emdavis@mun.ca>
Sent: Monday, October 23, 2023 2:53 PM
To: Cathy Hyde <cs-ugradadv@mun.ca>
Subject: FW: Calendar change proposal for review and feedback

Thank you for the opportunity to review the proposed changes. They should not impact pharmacy students or interns and so we have no concerns.

Erin

--

Dr. Erin Davis BSc (Pharm), PharmD

Associate Dean Undergraduate Studies

Associate Professor

Memorial University School of Pharmacy

PSYCHOLOGY

From: Psychology Deputy Head <psychdeputyhead@mun.ca>
Sent: Tuesday, October 24, 2023 11:30 AM
To: cs-ugradadv@mun.ca
Subject: RE: Calendar change proposal for review and feedback

Hi Cathy,

These changes all seem reasonable.

Best,

-Kathleen

Kathleen L. Hourihan, PhD (she/her)

Associate Professor

Deputy Head

Department of Psychology

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
Cover Page

LIST OF CHANGES

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- ☐ New course(s):
- X Amended or deleted course(s):
- ☐ New program(s):
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- ☐ Other:

ADMINISTRATIVE AUTHORIZATION

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Signature of Dean/Vice-President: _____

Date: _____

Date of approval by Faculty/Academic Council: _____

Senate Summary Page for MATH 1051

COURSE NUMBER AND TITLE

MATH 1051 Finite Mathematics II

RATIONALE

Executive Summary: The current version of M1051 has topics that do not relate well to each other, and many are not relevant for the students taking the courses. For many students, Mathematics 1050 and 1051 will be the only mathematics courses they take. These changes will help to reinforce their knowledge of basic mathematics that is largely applicable to life by focusing on how operations and number systems work and giving applications that encourage critical thought.

Longer Overview: Mathematics 1050 and 1051 largely serve students going into Primary/Elementary Education, Psychology or a minor in Mathematics, as an alternative to the calculus stream. Although the courses are often taken as a pair, they are not a sequence and students are not required to take both (either only needing one first year course, or having Mathematics 1090 as an alternative for the second course).

After consulting with colleagues in Education and Psychology, it was clear that the best focus in terms of preparing students for those programs would be getting students comfortable working with numbers and having a better conceptual understanding of more basic mathematics. Other suggestions from them were the geometry section including measurement and more focused on connections and understanding than calculations, and having a section with more direct application to life like statistics or data analysis. Linear programming and matrices were seen as largely unhelpful in terms of preparing students for their programs.

There will be one major topic added:

- Voting Systems: This section gives students an opportunity to work with data in a practical way, but without significantly overlapping with other courses. Evaluation of the fairness of different systems

Some topics are removed:

- Elementary matrices: Consultation with other departments indicated that this was not a useful topic for their students. For students using Mathematics 1050/1051 as an entrance to a minor in Mathematics, these topics will be covered in Mathematics 2050.
- Linear programming: Again, consultation with other departments indicated that this was not a useful topic for their students. This topic is not covered in higher level mathematics courses, and so would not be helpful in preparing students for a minor in Mathematics.

Some topics will be changed to better suit the course:

- Discussion of mathematical systems will focus on historical numeration systems and systems using different bases, rather than looking at the properties of Abelian groups. This gives students a deeper understanding of basic arithmetic. Students who continue with Mathematics will be introduced to Abelian groups in later courses.
- The geometry section has been reworked to be more focused on critical thinking than calculation. It will include information about measurement, work in mathematical reasoning in triangles, and a focus on proof over memorization in area, surface area and volume.

More details on changes and rationale can be found in the appendix.

With these changes there is no longer an overlap in topics between the St. John's MATH 1051 and Grenfell MATH 1052. Hence the credit restrictions are removed between these courses.

ANTICIPATED EFFECTIVE DATE
This new version will be available for students from September 2024.

CALENDAR CHANGES

MATH 1051 Finite Mathematics II covers topics which include ~~elementary matrices, linear programming~~, elementary number theory, ~~mathematical systems~~, <u>numeration systems, voting systems,</u> and geometry.

CR: ~~MATH 1052 and~~ MATH 1053

LC: 4

PR: a combination of placement test and high school mathematics scores acceptable to the department or the former MATH 103F

UL: At most 9 credit hours in Mathematics will be given for courses successfully completed from the following list subject to normal credit restrictions: Mathematics 1000, 1031, 1050, 1051, 1052, 1053, the former 1080, the former 1081, 1090, 109A/B, the former 1150 and 1151. Students who have already obtained 6 or more credit hours in Mathematics or Statistics courses numbered 2000 or above should not register for this course, and cannot receive credit for it.

CALENDAR ENTRY AFTER CHANGES

MATH 1051 Finite Mathematics II covers topics which include elementary number theory, numeration systems, voting systems, and geometry.

CR: MATH 1052 and MATH 1053

LC: 4

PR: a combination of placement test and high school mathematics scores acceptable to the department or the former MATH 103F

UL: At most 9 credit hours in Mathematics will be given for courses successfully completed from the following list subject to normal credit restrictions: Mathematics 1000, 1031, 1050, 1051, 1052, 1053, the former 1080, the former 1081, 1090, 109A/B, the former 1150 and 1151. Students who have already obtained 6 or more credit hours in Mathematics or Statistics courses numbered 2000 or above should not register for this course, and cannot receive credit for it.

SECONDARY CALENDAR CHANGES

Section 13.22 (Grenfell)

MATH 1052 Mathematics for Business covers topics which include elementary algebra and functions, sets, elementary probability, matrices, systems of equations, and linear programming.

CR: Math 1050 ~~and Math 1051~~

LC: 4

UL: students who already have obtained credit for 6 or more Mathematics credit hours numbered 2000 or above are not permitted to register for this course, nor can they receive credit for it.

Appendix for Changes to MATH 1051

CONSULTATIONS SOUGHT

Academic Unit	Response Received
Humanities and Social Sciences	Yes
Business Administration	Yes
Education	Yes
Engineering and Applied Science	Yes
Human Kinetics and Recreation	Yes
Marine Institute	
Medicine	

Academic Unit	Response Received
Music	
Nursing	Yes
Pharmacy	Yes
Science	
Biochemistry	
Biology	
Chemistry	
Computer Science	
Earth Sciences	
Mathematics and Statistics	
Ocean Sciences	
Physics and Physical Oceanography	
Psychology	Yes
Social Work	
Library	Yes
Grenfell - Arts and Social Science	

Academic Unit	Response Received
Grenfell - Science and the Environment	Yes
Grenfell - Fine Arts	
Labrador Institute	

Email sent out:

Hello Everyone,

The Department of Mathematics and Statistics seeks consultation on a revision to MATH 1051 (Finite Mathematics II). Significant numbers of Primary/Elementary Education and Psychology students take this course so it may be of particular interest to those units.

If you have any comments on these proposals, please respond to mathconsult@mun.ca by October 27.

Best Regards,
Ivan Booth
Deputy Head (Mathematics)
Dept of Math and Stats

Responses to Consultations:

Business:

Hi Ivan,

Thank you for the opportunity to review. We see no impact for Business.

Best,
Erin

ERIN OLDFORD, PhD (she/her)
Associate Dean of Undergraduate Programs and Accreditation,
Associate Professor of Finance, and
Faculty Advisor to The Fund
Faculty of Business Administration
Memorial University of Newfoundland
St. John's, Newfoundland & Labrador
www.business.mun.ca

Education:

Good afternoon,

Dr. Edith Furey, former AD in Education, forwarded a bunch of these consultation requests to me. Would you let me know if they are supposed to go to the Dean of Education? And, if so, do you need these sent out to our faculty?

Would you send any correspondence for the dean of Education to educdean@mun.ca?

Thanks
Roxanne

ROXANNE KEATS | DECANAL ASSISTANT

Faculty of Education
Memorial University of Newfoundland
G.A. Hickman Building | Room ED2007
Tel: 709 864-8588 | Fax 709 864-8637| rkeats@mun.ca
www.mun.ca/educ

Grenfell School of Science and the Enviroment (excerpted from a longer letter covering all proposed math/stats changes – we have implemented this change)

To whom it may concern:

Oct. 26, 2023

The mathematics unit at Grenfell Campus has met to discuss the proposed calendar changes from the Department of Mathematics and Statistics, for amended or new courses Math 1051, 2030, 3030, 4162, and 409A/B, as well as the amended programs Mathematics Major/Honours. We are supportive of all the proposals. Our feedback is below.

Math 1051

Currently, this course is credit restricted with Grenfell's Math 1052. However, with the proposed changes, the overlapping material (matrices and linear programming) will be removed from 1051, and we therefore request that a secondary change to your proposal be added to remove the credit restriction in the description of 1051 (in the St. John's section) and in the description of 1052 (in the Grenfell section). Incidentally, this is a positive side effect of the proposed changes, as Math 1052 is offered online, and so students on the St. John's campus could take the combination Math 1051 and Math 1052.

Rebecca Milley, PhD
Associate Professor and Chair, Mathematics School of Science and the Environment Grenfell Campus, Memorial University

Engineering:

Ivan,

Thank you for the opportunity to comment on the proposed Calendar changes to the major and honours in mathematics and to the courses MATH 2030, 3030, 409A/B, 1051, 3161, 4160 and 4162. For almost all of our students, none of these changes have any impact. Changes to some courses might affect the few engineering students taking a minor in mathematics. We support the proposed changes.

Glyn.

Dr. Glyn George, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science
Memorial University of Newfoundland
St. John's   NL   A1B 3X5

Humanities and Social Sciences:

Hello Dr. Booth,

Please see the below email response from Dr. Patricia Dold, Associate Dean, Curriculum and Programs, regarding the revised Mathematics Course: Math 1051 (Finite Mathematics II).

Regards,

Sarah

Sarah Penney (she/her)
Intermediate Clerk Stenographer
Faculty of Humanities and Social Sciences
Memorial University of Newfoundland
St. John's, NL A1C 5S7

Telephone: (709) 864-8254 Ext: 8254
Fax: (709) 864-7123
Email: sarap@mun.ca, hss@mun.ca

From: Dold, Patricia <pdold@mun.ca>
Sent: Saturday, September 30, 2023 6:54 AM

To: Faculty of Humanities and Social Sciences <hss@mun.ca>
Subject: Re: Consultation on Revised Mathematics Course: MATH 1051 (Finite Mathematics II)

HSS has no concerns with the changes to the course itself. On the UL, is it the case that students receive no credit as described, or that the course cannot count for a major/ minor under the circumstances described? If the later, edits would be needed.

P Dold
Associate Dean, Curriculum and Programs, HSS

Library:

Good evening Ivan,

These changes to the calendar entry for MATH 1051 will have no impact on the library.

Kathryn

_____

Kathryn Rose, MLIS, PhD (she/her) | Head (Interim), Collection Strategies
Humanities Research Liaison Librarian – History
Memorial University Libraries
St. John's, Newfoundland, A1B 3Y1
+1 709 864-3139
www.library.mun.ca

Nursing

Good morning Dr. Booth.

Dr. Pike (Interim Dean, Nursing) has reviewed the Math 4162 as well as the Math 1051 documentation attached and tells me that Nursing has no concerns or comments.

Thank you again for your time, I hope you have a great day.
Jane

Pharmacy:

Hi Ivan,

Thank you for the opportunity to comment on the proposed calendar change. We do not anticipate it will affect pharmacy students or programs and have no concerns.

Thank you,
Erin
--
Dr. Erin Davis BSc (Pharm), PharmD
Associate Dean Undergraduate Studies

Associate Professor
Memorial University School of Pharmacy
T 709 864 8815
E emdavis@mun.ca

Psychology:

Hi Ivan,

Thank you for the opportunity to review. We see no impact for Business.

Best,
Erin

ERIN OLDFORD, PhD (she/her)
Associate Dean of Undergraduate Programs and
Accreditation,
Associate Professor of Finance, and
Faculty Advisor to The Fund
Faculty of Business Administration
Memorial University of Newfoundland
St. John's, Newfoundland & Labrador
www.business.mun.ca

LIBRARY REPORT

Library:

Good evening Ivan,

These changes to the calendar entry for MATH 1051 will have no impact on the library.

Kathryn

Kathryn Rose, MLIS, PhD (she/her) | Head (Interim), Collection Strategies
Humanities Research Liaison Librarian – History
Memorial University Libraries
St. John's, Newfoundland, A1B 3Y1
+1 709 864-3139
www.library.mun.ca

RESOURCE IMPLICATIONS

This is an update of an existing course. There are no resource implications.

ADDITIONAL INFORMATION

Extra Course Details

Guiding Principle: Prepare students to work with numbers and data. Focus on conceptual understanding and critical thinking.

Outline of new course

The outline below gives the reasoning for including each unit, as well as a list of topics to be covered. The OpenStax book "Contemporary Mathematics" is used a reference, with sections noted for each topic, although supplemental material is needed in some areas.

Unit 1: Numeration systems (5 lectures)

- Gives cultural and historical context for numeration systems.
- Working in different bases gives a deeper understanding of arithmetic in the decimal system, since it forces students to examine basic operations they take for granted.

  i.   Understanding place value (4.1)

  ii. Early numeration systems (4.2)

  iii. Converting between number bases (4.3)

  iv. Operations in base systems (4.4)

Unit 2: Number Theory (9 lectures)

- Develops the building blocks of working with real numbers.
- Opportunities to immediately apply techniques (eg. Prime factorization to least common multiple to common denominator of fractions)
- Introduction of ratios, which directly applies to the following units.

  i.   Sets of real numbers

  ii.   Divisibility rules (3.1)

  iii. Prime and composite numbers (3.1)

  iv.   Prime factorization (3.1)

  v.   GCD and LCM (3.1)

  vi.   Rational and irrational numbers (3.4-3.5)

  vii. Ratios and percents (3.4)

Unit 3: Voting (10 lectures)

- Adds critical thinking similar to logic in 1050, but in a very different context. Students taking just one will have experience with critical thinking no matter which course they choose, but there is no overlap in topics for students who take both.
- Gives opportunities to work with data without replicating topics covered in many other courses.
- Apportionment is an application of working with ratios.

  i.   Voting methods (11.1)

  ii.   Fairness of voting methods and Arrow's impossibility theorem (11.2)

  iii. Apportionment (11.3)

  iv.   Methods of apportionment (11.4)

  v.   Fairness in apportionment (11.5)

Unit 4: Geometry (8 lectures)

- Further, more concrete, applications of ratios.
- Introduction of proof and using reasoning (not just calculation) in mathematics.
- A focus on where formulas for area, volume and surface area come from gives a better understanding of shapes, and students can be asked to prove formulas rather than memorize them.

  i.   The metric system (9.1)

  ii.   Lines and angles (10.1-10.2)

  iii. Types of triangles and polygons (10.3-10.4)

  iv.   Congruent and similar triangles (10.3)

  v.   Circumference and pi (10.4)

  vi.   Area calculation (10.6)

  vii. Volume and surface area of prisms (10.7)

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
Cover Page for Revision to MATH 3161 and 4160

LIST OF CHANGES

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

- ☐ New course
- ☐ **X 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: _____

Senate Summary Page for Math 3161

COURSE NUMBER AND TITLE

Math 3161 Ordinary Differential Equations II

RATIONALE

Summary: This proposal is part of our ongoing review and renewal of Mathematics courses. In these changes Math 3161 is re-envisioned as a course focusing on ordinary differential equation boundary value problems. It retains the existing theory on the existence and uniqueness of initial value problems, series solutions of differential equations and special functions of mathematical physics. To this it adds the basic theory of existence and uniqueness of boundary value problems, Sturm-Liouville theory and an introduction to the calculus of variations. It removes systems of ordinary differential equations (which are now covered in the new Math 2260).

Details:

Following the recent updates of our first and second year Calculus courses (1001 and 2000) along with the introductory differential equations course (2260) we are now proposing to update the next two courses in the differential equation sequence: Math 3161 Ordinary Differential Equations II and Math 4160 Introduction to Partial Differential Equations.

A repeating theme of these updates has been shifting material so that it appears earlier in the course sequence. This continues in this update. A major part of the Math 2260 revisions was to significantly deepen the coverage of systems of first order differential equations and associated initial value problems. The intention there was to ensure that students who take 2260 as their only differential equations course will still have seen and worked with the standard types of differential equations. For example, while second order equations are key to many physical applications, systems of first order equations are key to many applications in the life sciences (including population and disease modelling).

This material on first order equations was previously taught in Math 3161 and moving it to Math 2260 has freed up 2-3 weeks of class time. This will be partially filled with an introduction to the calculus of variations, a classical topic that goes back over 400 years and is a key concept in many of the physical and mathematical sciences but which has previously been missing from our curriculum.

The other significant change will be to fill a three week section of Math 3161 which, for the last number of years, has been designated as "advanced topics" in ordinary differential equations. It is somewhat unusual to have such a large section of instructor's choice material in a third-year course so, on the recommendation of the regular instructors, this proposal will also designate specific material to fill that space. The

material, Sturm-Liouville and the basic theory of boundary value problems, have often (though not always) been the chosen as the "advanced topics" and so making this official is essentially a recognition of a common existing practice.

The transfer of the three weeks of material on Sturm-Liouville theory and boundary value problems into 3161 will open up that space in 4160 where it currently sits as necessary background material for the method of separation of variables. However, it is a very important topic in ordinary differential equations in its own right and sits very naturally in Math 3161 as it provides theoretical background needed to recognize the special functions as basis functions which can be used to expand solutions to many differential equations.

As a consequence of these changes, three weeks of space will open up in Math 4160 (see accompanying proposal for details of how that will be used). Further Math 3161 will become a prerequisite for Math 4160.

In summary, the changes are:
1) The "instructor's choice" section will be fixed to be Sturm-Liouville theory.
2) The time previously allocated to systems of first order equations section will be reallocate to the introduction to two-point boundary value problems along with an introduction to the calculus of variations. This will naturally fit with 1) as the differential equations generated by variational methods are generally boundary value problems.

Earlier courses in the sequence (MATH 2000 and MATH 2260) have introduced symbolic and exploratory computing tools to supplement traditional instruction. They will continue to be used in this revision of 3161. For example, the differential equations derived from the calculus of variations generally do not have solutions that can be written in terms of elementary functions. Hence traditional courses generally restrict their attention to the small subset of problems with exact solutions. With access to easy-to-use numerical differential equation solvers, this is no longer necessary (or desirable).

ANTICIPATED EFFECTIVE DATE: Fall 2024

CALENDAR CHANGES

Old Calendar Language: 3161 Ordinary Differential Equations II examines power series solutions~~,~~ <u>and the</u> method of Frobenius, <u>along with</u> Bessel functions, Legendre polynomials <u>and other special functions from mathematical physics.</u> ~~others from classical Physics, systems of linear first order equations, fundamental matrix solution, existence and uniqueness of solutions, and advanced topics in ordinary differential equations.~~ <u>It also presents the existence and uniqueness theorems for initial and boundary value problems, representation of solutions of linear boundary value problems, Sturm-Liouville theory, and an introduction to the calculus of variations.</u>

    PR: MATH 2260 (or the former MATH 3260) and 3202

New Calendar Language: 3161 Ordinary Differential Equations II examines power series solutions and the method of Frobenius, along with Bessel functions, Legendre polynomials and other special functions from mathematical physics. It also presents the existence and uniqueness theorems for initial and boundary value problems, representation of solutions of linear boundary value problems, Sturm-Liouville theory, and an introduction to the calculus of variations.

    PR: MATH 2260 (or the former MATH 3260) and 3202

Senate Summary Page for MATH 4160

CURRENT COURSE NUMBER AND TITLE

M4160 Partial Differential Equations I

RATIONALE

The current calendar description of Mathematics 4160 (Partial Differential Equations I) has been unchanged in over 30 years. Not surprisingly, during that time the content of the course has somewhat shifted and so the description is in need of updating. This has now become more pressing as the accompanying update of Mathematics 3161 will bring back about three weeks of content (two-point boundary value problems and Sturm-Liouville theory) from 4160. The current proposal fills that gap with first-order partial differential equations, the method of characteristics and the maximum principle along with more on integral transform and Green's function methods. Parts of these topics have unofficially appeared in 4160 over the last decade however with the space that has opened, it will now be possible to properly cover these important topics in 4160. Earlier courses in the sequence (MATH 2000, 2260 and 3161) have introduced symbolic and exploratory computing tools to supplement traditional instruction. They will continue to be used in this revision of 4160. For example, when considering concrete examples of Fourier series, integral transforms or separation of variables, students will use computational tools to reduce the algebraic workload and visualize results. This will not only help them to understand the mathematics but also significantly extend the range (and number) of problems that may be considered.
These changes will better serve our students. As this will be the only course in partial differential equations that is taken by most of them, it is important that they see not only solution techniques but also learn some partial differential equation theory (the current version of 4160 is quite computational).
A consequence of the shift of Sturm-Liouville theory from 4160 to 3161 is that 3161 will now become a pre-requisite to 4160. In doing this it replaces all previous pre-requisites (as they are already required for 3161).

ANTICIPATED EFFECTIVE DATE: Fall 2024

CALENDAR CHANGES

Old Calendar Language: ~~**4160 Partial Differential Equations I** covers two point boundary value problems, Fourier series, Sturm-Liouville theory, canonical forms, classification and solution of linear second order partial differential equations in two independent variables, separation of variable, integral transform methods.~~

~~PR: MATH 2260 (or the former MATH 3260) and 3202~~

New Calendar Language: 4160 Partial Differential Equations I covers first-order partial differential equations, classification of second-order linear partial differential equations, separation of variables, Fourier series, Laplace's equation, the heat equation, wave equation, the method of characteristics, transform methods for the solution of initial/boundary value problems, Green's functions and the maximum principle.
PR: MATH 3161

Appendix for Changes to MATH 3161 and 4160

CONSULTATIONS SOUGHT

Academic Unit	Response Received
Humanities and Social Sciences	
Business Administration	Yes
Education	
Engineering and Applied Science	Yes
Human Kinetics and Recreation	Yes
Marine Institute	
Medicine	
Music	
Nursing	Yes
Pharmacy	Yes

Academic Unit	Response Received
Science	
Biochemistry	
Biology	
Chemistry	
Computer Science	
Earth Sciences	
Mathematics and Statistics	
Ocean Sciences	
Physics and Physical Oceanography	
Psychology	
Social Work	
Library	Yes
Grenfell - Arts and Social Science	Yes
Grenfell - Science and the Environment	
Grenfell - Fine Arts	
Labrador Institute	

Email sent out:

Hello Everyone,

The Department of Mathematics and Statistics seeks consultation on revisions to our courses MATH 3161 (Differential Equations II) and MATH 4160 (Introduction to Partial Differential Equations).

If you have any comments on these proposals, please respond to mathconsult@mun.ca by October 27.

Best Regards,
Ivan Booth
Deputy Head (Mathematics)
Dept of Math and Stats

Responses to Consultations:

Business:

Hi Ivan,

Thank you for the opportunity to review. We see no impact for Business.

Best,
Erin

ERIN OLDFORD, PhD (she/her)
Associate Dean of Undergraduate Programs and Accreditation,
Associate Professor of Finance, and
Faculty Advisor to The Fund
Faculty of Business Administration
Memorial University of Newfoundland
St. John's, Newfoundland & Labrador
www.business.mun.ca

Engineering:

Ivan,

Thank you for the opportunity to comment on the proposed Calendar changes to the major and honours in mathematics and to the courses MATH 2030, 3030, 409A/B, 1051, 3161, 4160 and 4162.   For almost all of our students, none of these changes have any impact.   Changes to some courses might affect the few engineering students taking a minor in mathematics.   We support the proposed changes.

Glyn.

Dr. Glyn George, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science
Memorial University of Newfoundland
St. John's   NL   A1B 3X5

Grenfell: School of Science and the Environment (excerpted from a full letter covering all the proposed math changes)

To whom it may concern:

Oct. 26, 2023

The mathematics unit at Grenfell Campus has met to discuss the proposed calendar changes from the Department of Mathematics and Statistics, for amended or new courses Math 1051, 2030, 3030, 4162, and 409A/B, as well as the amended programs Mathematics Major/Honours. We are supportive of all the proposals. Our feedback is below.

Math 1051

Currently, this course is credit restricted with Grenfell's Math 1052. However, with the proposed changes, the overlapping material (matrices and linear programming) will be removed from 1051, and we therefore request that a secondary change to your proposal be added to remove the credit restriction in the description of 1051 (in the St. John's section) and in the description of 1052 (in the Grenfell section). Incidentally, this is a positive side effect of the proposed changes, as Math 1052 is offered online, and so students on the St. John's campus could take the combination Math 1051 and Math 1052.

Rebecca Milley, PhD
Associate Professor and Chair, Mathematics School of Science and the Environment Grenfell Campus, Memorial University

Humanities and Social Sciences:

Hello Dr. Booth,

Please see the below email response from Dr. Patricia Dold Associate Dean, Curriculum and Programs about the updates to Math 3161 (Differential Equations II) and Math 4160 (Introduction to Partial Differential Equations).

Regards,

Sarah

Sarah Penney (she/her)
Intermediate Clerk Stenographer
Faculty of Humanities and Social Sciences
Memorial University of Newfoundland
St. John's, NL A1C 5S7

Telephone: (709) 864-8254 Ext: 8254
Fax: (709) 864-7123
Email: sarap@mun.ca, hss@mun.ca

From: Dold, Patricia <pdold@mun.ca>
Sent: Saturday, September 30, 2023 6:13 AM
To: Faculty of Humanities and Social Sciences <hss@mun.ca>
Subject: Re: Consultation on updates to MATH 3161 (Differential Equations II) and MATH 4160 (Introduction to Partial Differential Equations)

HSS has no concerns with the changes proposed. (Formatting of changes might be brought in line with Senate CCP pages).

P Dold
Associate Dean, Curriculum and Programs, HSS

Library:

Hi Ivan,

The calendar changes for MATH 3161 and MATH 4160 will have no impact on the library.

Kathryn Rose, MLIS, PhD (she/her) | Head (Interim), Collection Strategies
Humanities Research Liaison Librarian – History

Memorial University Libraries
St. John's, Newfoundland, A1B 3Y1
+1 709 864-3139
www.library.mun.ca

Nursing:

Good morning.

Dr. Pike (Interim Dean, Nursing) has reviewed the Math 4160 and 3161 documentation and tells me that Nursing has no concerns or comments.

Thank you again.
Jane

Pharmacy:

Hi Ivan,

Thank you for the opportunity to comment on the proposed calendar change. We do not anticipate it will affect pharmacy students or programs and have no concerns.

Thank you,
Erin
--
Dr. Erin Davis BSc (Pharm), PharmD
Associate Dean Undergraduate Studies
Associate Professor
Memorial University School of Pharmacy
T 709 864 8815
E emdavis@mun.ca

LIBRARY REPORT

Library:

Hi Ivan,

The calendar changes for MATH 3161 and MATH 4160 will have no impact on the library.

_____

Kathryn Rose, MLIS, PhD (she/her) | Head (Interim), Collection Strategies
Humanities Research Liaison Librarian – History
Memorial University Libraries
St. John's, Newfoundland, A1B 3Y1
+1 709 864-3139
www.library.mun.ca

RESOURCE IMPLICATIONS
This is an update of an existing course. There are no resource implications.

ADDITIONAL INFORMATION FOR MATH 3161

Mark Distribution

A typical mark distribution would be:

a) Assignments: 15%
b) Midterm: 25%
c) Project: 10%
d) Final Exam: 50%

The use of computer algebra significantly increases the possible range of questions that students can tackle on assignments and makes it possible to include deeper exploratory problems. Hence it more feasible to include projects and they have increasingly been included in courses in the calculus sequence (for example 2000 and 2260).

Text Book:
Much of the material is covered in standard text-books like
1) "Elementary Differential Equations and Boundary Value Problems 12th edition" by W.E Boyce, R.C. DiPrima and D.B. Meade (Wiley, 2021) *(BDM below)*
2) "Differential Equations: An introduction to Modern Methods and Applications" by J.R. Brannon and W.E. Boyce (Wiley, 2015) *(BB below)*
3) "Differential Equations with Applications and Historical Notes, 3rd editions" by G.F. Simmons (Chapman and Hall, 2023) *(S below)*

However, there will need to be some supplementation of the text with instructor's notes and assigned readings from other sources. Suitable supplementary material can, for example, be found in:
1) "Variational Methods with Applications in Science and Engineering" by K.W. Cassell (Cambridge University Press, 2013). *(KC below)*

2) "Computer Methods for Ordinary Differential Equations and Differential-Algebraic Equations" by U.M.Ascher and L.R.Petzold (SIAM, 1998) (*AP below*)
3) "Numerical Solution of Boundary Value Problems for Ordinary Differential Equations" by U.M.Ascher, R.M.M.Mattheij and R.D.Russell (SIAM, 1995) *(AMR below)*

These last books all contain much more material than is needed for the course. They are listed more as instructor resources (see course outline below) rather than for the students to read directly.

Course Outline

The sub-committee that proposed this revision put together the following (detailed) outline of what should be covered in the updated course.

Section 1: *Series Solutions to Initial Value Problems* **(~8 lectures)**

This is, for example, Chapter 5 of BP. It includes:

      a) Series solutions near an ordinary point, parts I and II
      b) Regular singular points
      c) Euler equations
      d) Series solutions near a Regular singular point, Parts I and II
      e) Bessel's Equation

  Notes: unchanged from the current offering

Section 2: *Existence and Uniqueness + Introduction to Boundary Value Problems* **(~6 lectures)**

Existence and uniqueness of initial value problems is a standard topic in standard differential equation texts (including all listed above). For boundary value problems it is a little less standard and so we note detailed sections from the supplementary texts

      a) Existence and Uniqueness for initial value problems (Picard iteration) Sec. 2.8 BP (2 lectures)
      b) Introduction to BVPs (Sec. 3.1.2 AMR) second order, higher order form, conversion to first order form (3.2), see also Ch. 1 for great applied examples of BVP ODEs (4 lectures). Detailed outline:
          i. Ex. 3.1 to show theoretical difference between IVP and BVP for (3.10)
          ii. See also Examples in Sec: 10.3 of BB, plus Exercises of Sec. 10.3 for assignment problems
          iii. (Thm. 3.11 AMR) A general nonlinear existence and uniqueness result for BVPs (dependence of the domain), compare to IVP result
          iv. (AMR Ex. 3.2) a nonlinear example with multiple solutions, (also Ex. 6.2 AP)
          v. Representation result for linear BVPs in first order form, Thm. 3.26 AMR, prove this.
          vi. Illustrate with (Ex. 3.3 AMR)

    vii.   (Sec. 3.2.1 AMR) introduce representation for linear BVPs in terms of the Green's function, show dependence on the problem data (conditioning)

    viii.   Ex. 3.4 AMR

    ix.   Discussion on p. 97 AMR starting below 3.41b) on the general construction of a Green's function based on solutions to the homogeneous problem

    x.   Ex. 3.5 AMR

Notes: Part a) is from the existing version of the course

Section 3: *Sturm-Liouville Theory for Boundary Value Problems* (**~8 Lectures**)

    This is well-covered in BB – conveniently in the "Online-only" Chapter 10 which can be found at:

https://bcs.wiley.com/hebcs/Books?action=chapter&bcsId=9431&itemId=1118531779&chapterId=107758

The relevant sections are:

a) Sec. 10.3. Introduction to eigenvalue problems for linear Boundary Value Problems. Exercises 19-25

b) Sec. 10.4 Introduce general Sturm-Liouville problems(need to review orthogonality to prove Thm 10.4.2)

c) Sec. 10.5 Goal here is to get to non-homogeneous Sturm-Liouville functions.
Need to represent the inhomogeneity in terms of the eigenfunction, can use a first specific example here, then general case.

d) Sec. 10.6 Singular Sturm-Liouville problems. Nice tie-in with special functions, series method from earlier in the course

e) Sec. 10.7: Convergence result for Fourier Series

Notes: This is the material from 4160 but can be presented slightly faster than it was there as boundary value problems have already been covered in Section 2. It is often already taught as the "instructor-choice" section of the course.

Section 4: *An Introduction to Calculus of Variations* (**~8 lectures**)

    All sections below are from KC. This material can also be found in Simmons.

a) Introduction to functionals Sec. 2.1 (2-3 lectures)

b) functional derivatives Sec. 2.1.1

c) Derivative of Euler's equation Sec. 2.1.1

d) Notation Sec. 2.1.3

e) Sec. 2.1.4 Special Cases of Euler's Equations

f) Sec. 2.2 Natural Boundary conditions (1-2 lectures)

g) Sec. 2.3. Variable Endpoints (1 lecture)

h) Sec. 2.4. An example of a functional containing higher order derivatives (1 lecture)

i) Sec. 2.7 Constrained functions, connection with Lagrange multiplier from Math 3202 (1 lecture)

j) Sec. 2.7.2 Connection with S-L problems (1 lecture)

Notes: This is new material to replace systems of first order ODEs. Historically (30 years ago!) it was sometimes taught in this course.

ADDITIONAL INFORMATION FOR MATH 4160

Mark Distribution

A typical mark distribution would be:

a) Assignments: 15%
b) Midterm: 25%
c) Project: 10%
d) Final Exam: 50%

The use of computer algebra significantly increases the possible range of questions that students can tackle on assignments and makes it possible to include deeper exploratory problems. Hence it more feasible to include projects and they have increasingly been included in courses in the calculus sequence (for example 2000 and 2260).

Text Book:
The primary text-book will likely continue to be the current one:
"Applied Partial Differential Equations with Fourier Series and Boundary Value Problems, 5th Edition" by R.Haberman (Pearson, 2012) *(RH below)*
However for purposes of outlining the curriculum below we also reference
   1) "Nonlinear Partial Differential Equations for Scientists and Engineers, 3rd Edition" by L.Debnath (Birkäuser, 2011) *(LD below)*
   2) "An introduction to nonlinear partial differential equations, 2nd Edition" by J.D.Logan (Wiley, 2008) *(DL below)*

Course Outline
The sub-committee that proposed this revision suggests the following outline of what should be covered in the updated course.
Section 1: First-order partial differential equations and the method of characteristics **(~4 Lectures)**
            This is covered in Chapter 12 or RH or Chapters 3 and 4 of LD. It includes:
         a) The method of characteristics (12.2, 12.3, 12.6 from RH)
         b) First order nonlinear PDEs (12.7 in RH, or Chapter 4 in LD)

Note: Section 1 is new material for 4160

Section 2: Fourier Series (~6 Lectures)
This is covered in Chapter 3 of RH and includes:

      a) Introduction (3.1)
      b) Statement of convergence theorem (3.2)
      c) Fourier cosine and sine Series (3.3)
      d) Term-by-term differentiation and integration (3.4-3.5)

Section 3 Classification of second-order linear PDEs and separation of variables
(~13 Lectures)
      a) Second order linear equations and classification (1.5 in LD, 1 lecture)
      b) Heat equation (1.1-1.4 in RH, 2 lectures)
      c) Method of separation of variables (2.1-2.5.1 in RH, 5 lectures)
      d) Wave equation (4.1-4.4 in RH, 3 lectures)
      e) Higher dimensional PDEs (7.1-7.3 in RH, 2 lectures)

Section 4 Transform methods for the solution of initial/boundary value problems
(~4 Lectures)
      a) Introduction (10.1 in RH)
      b) Heat equation on an infinite domain (10.2 in RH)
      c) Fourier transform pairs (section 10.3 in RH)
      d) Fourier Transform and the heat equation (section 10.4 in RH)
      e) Fourier sine and cosine transform (section 10.5 in RH)

Section 5 Green's functions **(~4 Lectures)**
      a) Green's functions for time independent boundary value problems (9.1-9.3.4 in RH)
      b) Fredholm alternative (9.4.1 and 9.4.2 in RH)
      c) Green's functions for Poission equation, Dirac delta (9.5.1,9.5.2 in RH)

Section 6 Maximum Principle **(~2 Lectures)**
      a) Maximum principles and comparison theorems (6.4 in DL)

Note: Sections 5 and 6 are new material for 4160.

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): Math 4162: Numerical Methods for Differential Equations
- ☐ 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
Math 4162: Numerical Methods for Differential Equations

RATIONALE
The current prerequisites for Math 4162 (Math 3132 and 4160) are overly restrictive, and make it difficult for us to offer Math 4160 and 4162 concurrently (as has been the case in recent years). We propose modifying these prerequisites to Math 2260, 3132, and 3202, as these cover all of the mathematical skills needed to enter Math 4162, namely differential equations, numerical analysis, and vector calculus. In recent years, students have been allowed to enter Math 4162 while taking Math 4160 (which has Math 2260 and 3202 as its prerequisites) as a corequisite and have performed satisfactorily. Eliminating the unnecessary prerequisites will make the course accessible to a broader group of students.

ANTICIPATED EFFECTIVE DATE
Fall 2024

CALENDAR CHANGES

MATH 4162 Numerical Methods for Differential Equations
covers numerical solution of initial value problems for ordinary differential equations by single and multi-step methods, Runge-Kutta, and predictor-corrector; numerical solution of boundary value problems for ordinary differential equations by shooting methods, finite differences and spectral methods; numerical solution of partial differential equations by the method of lines, finite differences, finite volumes and finite elements.
PR: MATH 2260, 3132 and 32024160

CALENDAR ENTRY AFTER CHANGES

MATH 4162 Numerical Methods for Differential Equations

covers numerical solution of initial value problems for ordinary differential equations by single and multi-step methods, Runge-Kutta, and predictor-corrector; numerical solution of boundary value problems for ordinary differential equations by shooting methods, finite differences and spectral methods; numerical solution of partial differential equations by the method of lines, finite differences, finite volumes and finite elements.

PR: MATH 2260, 3132 and 3202

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
Appendix Page

CONSULTATIONS SOUGHT

Academic Unit	Response Received
Humanities and Social Sciences	
Business Administration	Yes
Education	
Engineering and Applied Science	Yes
Human Kinetics and Recreation	
Marine Institute	
Medicine	
Music	
Nursing	Yes
Pharmacy	Yes
Science	
Biochemistry	
Biology	

Academic Unit	Response Received
Chemistry	
Computer Science	
Earth Sciences	
Mathematics and Statistics	
Ocean Sciences	
Physics and Physical Oceanography	
Psychology	
Social Work	
Library	Yes
Grenfell - Arts and Social Science	
Grenfell - Science and the Environment	Yes
Grenfell - Fine Arts	
Labrador Institute	

Email sent out:

Hello Everyone,

The Department of Mathematics and Statistics seeks consultation on an update to the pre-requisites for MATH 4162 (Numerical Methods for Differential Equations).

If you have any comments on these proposals, please respond to mathconsult@mun.ca by October 27.

Best Regards,
Ivan Booth
Deputy Head (Mathematics)
Dept of Math and Stats

Responses to Consultations:

Business:

Hi Ivan,

Thank you for the opportunity to review. We see no implications for Business.

Best,
Erin

ERIN OLDFORD, PhD (she/her)
Associate Dean of Undergraduate Programs and
Accreditation,
Associate Professor of Finance, and
Faculty Advisor to The Fund
Faculty of Business Administration
Memorial University of Newfoundland
St. John's, Newfoundland & Labrador
www.business.mun.ca

Engineering:

Ivan,

Thank you for the opportunity to comment on the proposed Calendar changes to the major and honours in mathematics and to the courses MATH 2030, 3030, 409A/B, 1051, 3161, 4160 and 4162.   For almost all of our students, none of these changes have any impact.   Changes to some courses might affect the few engineering students taking a minor in mathematics.   We support the proposed changes.

Glyn.

Dr. Glyn George, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science
Memorial University of Newfoundland
St. John's   NL   A1B 3X5

Grenfell: School of Science and the Environment (excerpted from a full letter covering all the proposed math changes)

To whom it may concern:

Oct. 26, 2023

The mathematics unit at Grenfell Campus has met to discuss the proposed calendar changes from the Department of Mathematics and Statistics, for amended or new courses Math 1051, 2030, 3030, 4162, and 409A/B, as well as the amended programs Mathematics Major/Honours. We are supportive of all the proposals. Our feedback is below.

Math 4162

We have no concerns, and this change has the added benefit of Grenfell being able to offer the course (as previously our students would not have had all the prerequisites).

Rebecca Milley, PhD
Associate Professor and Chair, Mathematics
School of Science and the Environment
Grenfell Campus, Memorial University

Library:

Good evening Ivan,

The changes to the prerequisites for MATH 4162 will have no impact on the library.

_____

Kathryn Rose, MLIS, PhD (she/her) | Head (Interim), Collection Strategies
Humanities Research Liaison Librarian – History
Memorial University Libraries
St. John's, Newfoundland, A1B 3Y1
+1 709 864-3139
www.library.mun.ca

Nursing:

Good morning Dr. Booth.

Dr. Pike (Interim Dean, Nursing) has reviewed the Math 4162 as well as the Math 1051 documentation attached and tells me that Nursing has no concerns or comments.

Thank you again for your time, I hope you have a great day.
Jane

Pharmacy:

Hi Ivan,

Thank you for the opportunity to comment on the proposed calendar change. We do not anticipate it will affect pharmacy students or programs and have no concerns.

Thank you,
Erin

--
Dr. Erin Davis BSc (Pharm), PharmD
Associate Dean Undergraduate Studies
Associate Professor
Memorial University School of Pharmacy
T 709 864 8815
E emdavis@mun.ca

LIBRARY REPORT

Library:

Good evening Ivan,

The changes to the prerequisites for MATH 4162 will have no impact on the library.

_____

Kathryn Rose, MLIS, PhD (she/her) | Head (Interim), Collection Strategies
Humanities Research Liaison Librarian – History
Memorial University Libraries
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RESOURCE IMPLICATIONS
None

ADDITIONAL INFORMATION REQUIRED FOR NEW COURSE PROPOSALS

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
Cover Page
Mathematics Major and Honours Degrees
+ MATH2030/3030 (Mathematical Inquiry I & II)
+ MATH 409A/B (Honours Project in Mathematics)

LIST OF CHANGES

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

- X New course(s):
- X Amended or deleted course(s):
- X New program(s):
- X 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 and Labrador Undergraduate Calendar Change Proposal Form Senate Summary Page for Programs Mathematics Major and Honours Degrees

PROGRAM TITLE
BSc in Applied Mathematics (Major/Honours)
BSc in Pure Mathematics (Major/Honours)
BA in Pure Mathematics (Major/Honours)

REVISED PROGRAM TITLE
BSc in Mathematics (Major/Honours)
BA in Mathematics (Major/Honours)

RATIONALE

Summary: This proposal replaces the current Applied and Pure Math Majors/Honours degrees with single Mathematics Majors/Honours degrees. This change maintains core mathematical requirements while introducing greater choice and flexibility to the degrees. This new version also devotes more time to developing important ancillary skills such as writing, doing presentations, working in groups and using computers.

Longer Rationale: In Fall 2018, the Department of Mathematics and Statistics underwent an Academic Unit Planning process. The AUP Committee Report was received in early 2019 and had several recommendations re our undergraduate programs.

Many specific recommended changes have already been implemented. For example, the AUP Committee recommended:

"That the Department investigate whether having a single calculus sequence that is taken by all students is a barrier to development of programs and initiatives. Most universities have several such sequences, for example separate sequences for Physical Sciences and Engineering, Life Sciences, and Business and Economics."

Since that time, we have introduced streams into our introductory calculus course: besides the standard Calculus I (MATH 1000) we now also have Calculus for Business (MATH 1005) and Calculus for the Life Sciences (MATH 1006).

There was also a more general recommendation. Noting that our last major curriculum revision occurred more than 30 years ago in the 1980s, they recommended that the Statistics and Mathematics Undergraduate Studies Committee (SMUGS):

"undertake a thorough review of the course offerings and programs and make recommendations to the Department. Further, that particular attention be paid to course overlap and alignment, pathways to the graduate program, and providing sufficiently flexible programs that students who have completed core requirements can tailor to suit their own interests."

Over the last couple of years, we have introduced significant changes to refresh many of our course offerings and increase their relevance to the modern world. These include Calculus II (MATH 1001), Calculus III (MATH 2000), Ordinary Differential Equations I (MATH 2260), Differential Equations II (MATH 3161) and Partial Differential Equation (MATH 4160). There are more of these course-by-course changes to come. However, this proposal takes up the review of the programs themselves.

Currently, the Department of Mathematics and Statistics offers two majors in mathematics: Applied Mathematics and Pure Mathematics. These were introduced during the aforementioned 1980s curriculum revision. This proposal will replace these with a Mathematics Major and a Mathematics Honours degree.

Apart a general reassessment of our programs and consideration of whether they still match the needs of our students, there are several other motivations for this change:

1) Philosophically, we no longer believe that we should be putting our students into two silos and so restricting the areas of mathematics that they can study. Mathematics is mathematics and there is no need to split it into two camps.
2) The exact boundary between "pure" and "applied" mathematics is very unclear. Applications inspired much of pure mathematics and conversely it is quite common for areas originally thought to be completely pure to actually have many applications. Hence it is useful to study material from both sides, even for students who believe themselves to be only in interested in one aspect.
3) Perhaps as a reflection of the first two points, the existing pure and applied degrees have been growing back together since their decades old split. Originally, they shared first year requirements but then began to diverge at second year and by third year they were almost completely distinct. However, incremental changes over the last two decades mean that they now share 12 common courses. This includes (likely) all of first and second year[1] as well as two

---

[1] Both require 1000, 1001, 2000, 2050, 2051, 2130, 2320, a first year computing course and a statistics course. There is a slight complication for 2260: Applied Mathematics requires it while Pure Mathematics only requires one

(or three) third year requirements[2]. This proposal largely retains that evolved consensus as the core degree requirements. In some sense, it is just a recognition of this ongoing evolution.

4) Over the last couple of decades, most degrees at Memorial have become less prescriptive, giving students more opportunity to tailor the degree to their particular needs and interests. These changes are in that vein and introduce greater choice in the single Major/Honours than existed in either of the split versions. That said, modulo the addition of 3030, it would also be possible for students to obtain the Mathematics Major (or Honours) by completing the requirements for either of the old degrees.

5) While the core of mathematics has not changed since the last program revision, the world has changed tremendously around it. In particular computers today are orders of magnitude more powerful than they were in the 1980s and there is now widespread availability of both specialized and general-purpose mathematical software. These tools are not only valuable for learning, but they will also inevitably play a key role in any future job that our students may have, either inside or outside of academia. As such our students should be comfortable using them both for learning and research. Recent changes have increased the role of these tools in existing courses (MATH 2000 and MATH 2260). The proposed Major/Honours continues this trend with the introduction of two new courses: Mathematical Inquiry I (MATH 2030 – a revision of the existing 2130) and Mathematical Inquiry II (MATH 3030). Both include using modern technology to assist in mathematical investigations. For a full description of these courses see the attached course proposals.

6) Of course, mathematical knowledge along with an ability to make good use of computers are not the only skills that our students need to either continue on to grad school or to find a job directly after their degree. They also need ancillary skills such as working in groups, writing reports and doing presentations. Groupwork and presentations have already been introduced in the revised versions of MATH 2000 and MATH 2260, however they will be directly focused on in the new MATH 2030 and MATH 3030. Note that these are not new components of a mathematics degree. Since the 1980s, all of our students have taken Technical Writing (MATH 2130) which has evolved to the point that we are now rebranding it as MATH 2030 (Mathematical Inquiry I). Further, since that same time, applied mathematics students have taken Mathematical Modelling (MATH 4190)[3]. MATH 3030 is the successor to this course, though with some change of emphasis to encompass both "applied" and "pure" mathematics.

---

of 2260, 3202 or 3210. Many, if not most, Pure Mathematics students will choose 2260 and in that case, the requirements for the first two years will be identical.

[2] The two are 3000 and 3001. 3202 might also be common depending on the choice that a Pure Mathematics student takes from 2260, 3202 or 3210.

[3] For a decade or more they also took 3190 Introduction to Mathematical Modelling.

Note: these updates will leave the Math Minor unchanged and also leave unchanged the possibility of doing Mathematics as either a BSc or BA degree.

ANTICIPATED EFFECTIVE DATE
These programs will be available for students from September 2024.

CALENDAR CHANGE

I)   Section 11.9 (Science)

In the current Calendar **delete**:

11.9.4 Major in Applied Mathematics (B.Sc. Only)

11.9.5 Major in Pure Mathematics

11.9.7 Honours in Applied Mathematics (B.Sc. Only)

11.9.8 Honours in Pure Mathematics

In the current Calendar **add**

e) 11.9.? Major in Mathematics

As a component of the Degree Regulations for the General Degree of Bachelor of Science or the Degree Regulations for the General Degree of Bachelor of Arts, as appropriate, a student shall successfully complete the following requirements:

1. Mathematics 1000, 1001, 2000, 2030, 2050, 2051, 2260, 2320, 3000, 3030, 3202.
2. Twelve further credit hours in Mathematics courses numbered 3000 or higher, at least 6 of which must be in courses numbered 4000 or higher.
3. One of Computer Science 1001, Computer Science 1510, Engineering 1020 or an equivalent course in computer programming.
4. Statistics 2410.

f) 11.9.? Honours in Mathematics

See Degree Regulations for the Honours Degree of Bachelor of Science or Bachelor of Arts (Honours) Degree Regulations (as appropriate). A student shall successfully complete the following requirements:

1. Mathematics 1000, 1001, 2000, 2030, 2050, 2051, 2260, 2320, 3000, 3001, 3030, 3202, 3210, 3320, 409A/B.
2. Twenty-seven further credit hours in Mathematics courses numbered 3000 or higher, at least 18 of which must be in courses numbered 4000 or higher.

3. <u>One of Computer Science 1001, Computer Science 1510, Engineering 1020 or an equivalent course in computer programming.</u>
4. <u>Statistics 2410.</u>

Renumber sections as appropriate.

****

To summarize, after all of these changes (and the accompanying ones for Data Science) the sections should be:

11.9.1 Regulations
11.9.2 Faculty Advisors
11.9.3 Course Numbering System
11.9.4 Data Science Major
11.9.5 Mathematics Major
11.9.6 Statistics Major
11.9.7 Honours in Mathematics
11.9.8 Honours in Statistics
11.9.9 Minor in Mathematics
11.9.10 Minor in Statistics

II)   Section 15.12 (Humanities and Social Sciences)

These link back to the Science section and so don't need to be changed separately.

CALENDAR ENTRY AFTER CHANGES (Science)

11.9.? Major in Mathematics

As a component of the Degree Regulations for the General Degree of Bachelor of Science or the Degree Regulations for the General Degree of Bachelor of Arts, as appropriate, a student shall successfully complete the following requirements:

1. Mathematics 1000, 1001, 2000, 2030, 2050, 2051, 2260, 2320, 3000, 3030, 3202.
2. Twelve further credit hours in Mathematics courses numbered 3000 or higher, at least 6 of which must be in courses numbered 4000 or higher.
3. One of Computer Science 1001, Computer Science 1510, Engineering 1020 or an equivalent course in computer programming.
4. Statistics 2410.

11.9.? Honours in Mathematics

See [Degree Regulations](#) for the Honours Degree of Bachelor of Science or [Bachelor of Arts (Honours) Degree Regulations](#) (as appropriate). A student shall successfully complete the following requirements:

1. Mathematics 1000, 1001, 2000, 2030, 2050, 2051, 2260, 2320, 3000, 3001, 3030, 3202, 3210, 3320, 409A/B.
2. Twenty-seven further credit hours in Mathematics courses numbered 3000 or higher, at least 18 of which must be in courses numbered 4000 or higher.
3. One of Computer Science 1001, Computer Science 1510, Engineering 1020 or an equivalent course in computer programming.
4. Statistics 2410.

SECONDARY CALENDAR CHANGES

These secondary calendar changes all involve replacing references to Pure Mathematics as it appears in various instances as an Humanities and Social Sciences degree to Mathematics.

Faculty of Science Section of the Calendar

Between Sections 1 and 2:

While the Joint Degrees of Bachelor of Science and Bachelor of Arts is available to all Major programs offered by the Faculty of Science and the Faculty of Humanities and Social Sciences, students pursuing a major outside of Computer Science, Economics, Geography, Mathematics, Psychology, ~~Pure Mathematics~~ or Statistics should pay special attention to course planning and selection to ensure that this requirement is met within the required 135 credit hours.

Faculty of Humanities and Social Sciences Section of the Calendar

> **I)   Section 6.1.3.1 Major Programs of Study**

3.c. Interdisciplinary Major programs may also be combined with Majors from the following disciplines offered by the Faculty of Science: Computer Science, ~~Pure~~ Mathematics, Psychology, Statistics

> **II)   Section 6.2 (International Bachelor of Arts (iBA) Degree Regulations)**

4. The iBA is not available with a Major in an interdisciplinary program (Communication Studies, Criminology, Medieval and Early Modern Studies) or a Faculty of Science

program (Computer Science, <u>Mathematics,</u> Psychology, ~~Pure Mathematics,~~ Statistics) unless the student also completes an eligible Honours or Major program.

    III)   Section 6.8 (Joint Degrees of Bachelor of Science and Bachelor of Arts)

End of 1. (following f.)

While the Joint Degrees of Bachelor of Science and Bachelor of Arts is available to all Major programs offered by the Faculty of Science and the Faculty of Humanities and Social Sciences, students pursuing a major outside of Computer Science, Economics, Geography, <u>Mathematics,</u> Psychology, ~~Pure Mathematics~~ or Statistics should pay special attention to course planning and selection to ensure that this requirement is met within the required 135 credit hours.

Senate Summary Page for MATH 2030 and 3030

COURSE NUMBER AND TITLE

MATH 2030 Mathematical Inquiry I / MATH 3030 Mathematical Inquiry II

ABBREVIATED COURSE TITLE

MATH 2030 Mathematical Inquiry I / MATH 3030 Mathematical Inquiry II

RATIONALE

Executive Summary: In the proposed Mathematics Major and Honours degree, there is an increased emphasis on skills such as working on larger problems (often in collaboration with other students), making use of computational tools, and presenting the results of that work in both written reports and presentations. While many of these elements are being inserted into existing courses, MATH 2030 and 3030 (Mathematical Inquiry I and II), will be entirely devoted to these skills. They build on the experience gained from two existing courses MATH 2130 (Introduction to Technical Writing in Mathematics) and MATH 4190 (Mathematical Modelling) which they will replace.

Longer Overview: The analytical and problem-solving skills learned during a mathematics major are increasingly important and sought after in the modern world. However, mathematicians (both in academia and in industry) require more than just a deep understanding of mathematical theory. There are also critical ancillary skills. These include applying mathematical knowledge and ways of thinking to solving both large and small problems, being able to research, assimilate and develop new knowledge outside of the classroom, making good use of computational tools to

supplement analytical reasoning, working in collaboration with others, and being able to present results in both written and verbal form.

In the current majors, MATH 2130 (Technical Writing in Mathematics) focuses directly on these types of skills and has been a core course in the Applied and Pure Mathematics programs for almost four decades. It is a project course which, in its calendar described form, has students work and then write reports on four relatively lengthy problems. It plays some of the same roles as the lab courses in other Science departments but also fills its own unique position as a second-year course with a focus on independent work, multiweek projects and written reports. Post-graduation it is quite common for majors to tell us that it was the best part of their undergraduate degree.

Despite the course name and description, technical writing has always been just one component of MATH 2130. Most obviously, students need to complete their research projects before writing about them and so MATH 2130 has been a place where they learn to apply their mathematical knowledge outside of weekly assignments and tackle larger problems. The projects are generally open-ended with no definite conclusion and so students are encouraged to chart their own paths, investigating the mathematics with a curiosity-driven approach. Most (but not all) projects have also included a computational component which has provides them with practice solving problems with the help of a computer. Along with traditional programming, the course often introduces new high-level tools, such as computer algebra, that can be more convenient for mathematical problem solving. In some offerings the course includes group work, presentations and/or peer critiques. Other offerings have organized the projects around a common theme with each one building on its predecessors.

Recognizing the importance of these skills, in the revised Mathematics Major we propose replacing MATH 2130 with a sequence of two courses: MATH 2030 Mathematical Inquiry I and MATH 3030 Mathematical Inquiry II. We considered having these positioned in 3rd and 4th year, but decided that it is important to start developing these skills in our students as early as possible in their degree program. For the same reason, we also rejected the idea of increasing the pre-requisites to MATH 2030.

MATH 2030 and 3030 will be required for all Mathematics majors as part of the Common Core of courses and be restricted to our majors. The restriction will be in place not only so that we can focus on the needs of our students, but also to ensure that these courses will be a place where they can meet, interact and develop connections both with other majors and with the course instructors. Most of the other courses in the Core (such as MATH 2000, MATH 2050, MATH 2260 and MATH 3202) are also service courses that include large numbers of non-majors and so it is important to also have some courses that focus on the needs of our own majors. All of these goals are supported by keeping the class size relatively small.

The change in the second digit (0) reflects the intention that these should be core mathematics courses as opposed to "applied" or "pure" mathematics. Changing the

course number will also ensure that there are no problems for Grenfell Campus which may wish to continue with the former 2130.

We recommend that when these courses are assigned, they should be team taught by a common group of instructors with diverse research interests. For example, if both were to offered in Fall and Winter (as 2130 now is), then they should be assigned to four instructors with each getting 1⁄4 credit for each course. This would ensure that the students are exposed to as wide a range of mathematics (and hence projects) as possible. It would also formalize the historical teaching pattern for 2130: when there were multiple sections, they were usually (unofficially) team taught with each instructor proposing some projects which were then shared among all sections. This team approach would also make it easier for new people to become involved in teaching these courses.

CALENDAR CHANGES Section 13.9.1

Delete the following course:

MATH 2130 Technical Writing in Mathematics is a project oriented course combining mathematical investigation and technical writing. By using computer programming, graphical and typesetting tools, students will explore mathematical concepts and will produce technical reports of professional quality. The latter will combine elements of writing and graphics to convey technical ideas in a clear and concise manner.

PR: admission to Applied or Pure Mathematics major and MATH 1001 and (Computer Science 1510 or 1001 or 2001, or Engineering 1020; or permission of the Head of Department)

Add the following two courses:

1) **MATH 2030** Mathematical Inquiry I is a course in which students engage in mathematical investigation, and communicate the results of their work in the form of written technical reports and oral presentations. Students will study problems using both analytical methods and computational tools, such as traditional programming languages, computer algebra systems, and other forms of mathematical software.

CR: MATH 2130
PR: admission to a major offered by the Department of Mathematics and Statistics and MATH 1001 and (Computer Science 1510 or 1001 or 2001, or Engineering 1020; or permission of the Head of Department)

2) **MATH 3030** Mathematical Inquiry II is a continuation of MATH 2030. It builds on, and further refines, the skills developed in that course by exposing students to more complex mathematical investigations which require advanced techniques and more sophisticated approaches.

PR: admission to a major offered by the Department of Mathematics and Statistics and MATH 2000, MATH 2030 and MATH 2050.

SECONDARY CHANGES

All of these changes replace "2130" with "2030 (or the former 2130)"

Section 10.1.1 Applied Mathematics and Computer Science Joint Major

2. Mathematics 1000, 1001, 2000, 2050, 2051, ~~2130~~ 2030 (or the former 2130), 2260, 2320, 3000, 3100, 3132, 3161, 3202, 4160, and 4190.

10.1.2 Applied Mathematics and Economics Joint Major

1. Mathematics 1000, 1001, 2000, 2050, 2051, ~~2130~~ 2030 (or the former 2130), 2260, 2320, 3000, 3100, 3202, Statistics 2550.

10.1.3 Applied Mathematics and Physics Joint Major

8. A writing course. Any one of Mathematics 2030, 2130, Physics 3900, Mathematics 419A/B, or Physics 490A/B is acceptable.

The last requirement does not have to be met independently of the other regulations. For example, it can be satisfied ~~either~~ by choosing ~~Mathematics 2130 from clause 5. above or choosing~~ Physics 3900 as a 3000+ elective in clause 8. above.

NOTE: The deleted phrase refers to a clause that was changed in a previous calendar edit.

10.1.7 Computer Science and Pure Mathematics Joint Major

3. Mathematics 1000, 1001, 2000, 2050, 2051, ~~2130~~ 2030 (or the former 2130), 2260, 2320, 3000, 3202, 3320, 3340, and Statistics 2550.

10.1.10 Economics and Pure Mathematics Joint Major

1. Mathematics 1000, 1001, 2000, 2050, ~~2130~~ 2030 (or the former 2130), 2260, 2320, 3000, 3100, 3202, 3320, Statistics 2550 and one 4000 level Mathematics course.

10.2.2 Applied Mathematics and Physics Joint Honours

9. Twelve credit hours in applicable elective courses. Mathematics 2030 (or the former 2130) ~~2130~~ is recommended.

10.2.18 Computer Science and Pure Mathematics Joint Honours

The following courses in Mathematics and Statistics are required

1. Mathematics 1000, 1001, 2000, 2050, 2051, 2030 (or the former 2130) ~~2130,~~ 2260, 2320, 3000, 3001, 3202, 3210, 3320, 3340, Statistics 2550.

10.2.26 Pure Mathematics and Statistics Joint Honours

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

Mathematics 1000, 1001, 2000, 2050, 2051, 2030 (or the former 2130) ~~2130,~~ 2260, 2320, 3000, 3001, 3202, 3210, 4000, Statistics 1510 or 2500 or 2550, 2410 or 3410, 2501 or 2560, 3411, 3520, 3521, 4402, 4410, 4530;

Senate Summary Page for MATH 409A/B

COURSE NUMBER AND TITLE

MATH 409A/B Honours Project in Mathematics

RATIONALE

With the introduction of the new Mathematics Honours degree, we also need an Honours Project to go with it: the current Honours project courses 419A/B and 439A/B are respectively Applied and Pure Mathematics specific. This is that course.

Given the creation of the MATH 2030 and 3030 (Mathematical Inquiry I and II) it makes sense to have them as prerequisites for the Honours Project. However, some students from Joint Honours degrees may not have to complete these courses and so they are only listed as recommended.

CALENDAR CHANGES

409A/B Mathematics Honours Project is a two-semester linked course (six credit hours) that requires the student, with supervision by a member of the department, to prepare a dissertation in an area of Mathematics. In addition to a written project, a presentation will be given by the student at the end of the second semester.

PR: Registration in an honours or joint honours program in mathematics. MATH 3030 is recommended.

Memorial University of Newfoundland
Undergraduate Calendar Change Proposal Form
Appendix Page

CONSULTATIONS SOUGHT

Academic Unit	Response Received
Humanities and Social Sciences	
Business Administration	Yes
Education	
Engineering and Applied Science	Yes
Human Kinetics and Recreation	
Marine Institute	
Medicine	
Music	

Academic Unit	Response Received
Nursing	Yes
Pharmacy	Yes
Science	
Biochemistry	
Biology	
Chemistry	
Computer Science	
Earth Sciences	
Mathematics and Statistics	
Ocean Sciences	Yes
Physics and Physical Oceanography	
Psychology	
Social Work	
Library	Yes
Grenfell - Arts and Social Science	
Grenfell - Science and the Environment	Yes

Academic Unit	Response Received
Grenfell - Fine Arts	
Labrador Institute	

Responses to Consultations:

Email sent out (Sept 29):

Hello Everyone,

The Department of Mathematics and Statistics seeks consultation on our new Mathematics Major and Mathematics Honours BSc and BA degrees (attached). These will replace the existing Pure Mathematics and Applied Mathematics Majors and Honours Degrees. As part of these changes we also propose to replace the existing Mathematics 2130 (Technical Writing in Mathematics) and Mathematics 4190 (Mathematical Modelling) with Mathematics 2030 and 3030 (Mathematical Inquiry I and II). A new Honours Project course MATH 409A/B is also be introduced. A couple of notes

1) For Departments with whom we offer Joint Degrees, these are not addressed by this change. Changes to the joint degrees will probably come next year (after discussion with the partner Departments).
2) MATH 2030 and 3030 will be restricted to Mathematics Majors and Honours students.

If you have any comments on these proposals, please respond to mathconsult@mun.ca by October 27.

Best Regards,
Ivan Booth
Deputy Head (Mathematics)
Dept of Math and Stats

Business:

Hello Ivan,

Thank you for the opportunity to review. We welcome these changes, as they offer much more flexibility.

One editorial comment, the course numbers in the proposal do not have the titles, and it would be helpful to the reader to have them included.

Erin

Engineering:

Ivan,

Thank you for the opportunity to comment on the proposed Calendar changes to the major and honours in mathematics and to the courses MATH 2030, 3030, 409A/B, 1051, 3161, 4160 and 4162.   For almost all of our students, none of these changes have any impact.   Changes to some courses might affect the few engineering students taking a minor in mathematics.   We support the proposed changes.

Glyn.

Dr. Glyn George, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science
Memorial University of Newfoundland
St. John's   NL   A1B 3X5

Grenfell School of Science and the Environment (excerpted from longer letter covering several changes)

To whom it may concern:

Oct. 26, 2023

The mathematics unit at Grenfell Campus has met to discuss the proposed calendar changes from the Department of Mathematics and Statistics, for amended or new courses Math 1051, 2030, 3030, 4162, and 409A/B, as well as the amended programs Mathematics Major/Honours. We are supportive of all the proposals. Our feedback is below.

Major in mathematics

We are supportive of the move to a single major in "mathematics" and of the removal of Math 3001 from non-honours, both of which align with the changes Grenfell made to its major last year. The new proposed major has fewer 3000-level and 4000-level courses than the current majors in applied mathematics and pure mathematics, and the Grenfell major in mathematics, because of the 15-course limit for majors in the Faculty of Science. For institutional consistency, we may consider changing the requirements for our major in the future.

Rebecca Milley, PhD
Associate Professor and Chair, Mathematics School of Science and the Environment Grenfell Campus, Memorial University

Pharmacy:

Hi Ivan,

Thank you for the opportunity to comment on the proposed calendar change. We do not anticipate it will affect pharmacy students or programs and have no concerns.

Thank you,
Erin
--
Dr. Erin Davis BSc (Pharm), PharmD
Associate Dean Undergraduate Studies
Associate Professor
Memorial University School of Pharmacy
T 709 864 8815

E emdavis@mun.ca

Nursing:

Good morning Dr. Booth.

Dr. Pike (Interim Dean, Nursing) has reviewed the Math major/honors documentation and tells me that Nursing has no concerns or comments.

Thank you for your time, I hope you have a great day.
Jane

Ocean Sciences:

Hi Ivan

I don't have any further concerns or comments from Ocean Sciences everything looks good

Iain McGaw

--
****
Professor
Department of Ocean Sciences
0 Marine Lab Road
Memorial University
St John's, NL
Canada
A1C 5S7
Tel: 709 864-3272
Fax: 709 864-3220

LIBRARY REPORT

Hi Ivan,

While I was reading this proposal, I came across the concepts of research and "making use of resources independently" on several occasions. I was hoping to get a bit of clarification on the type of research involved so I can accurately assess the impact of these changes on the library.

Many thanks,

Kathryn

_____

Kathryn Rose, MLIS, PhD (she/her) | Head (Interim), Collection Strategies
Humanities Research Liaison Librarian – History
Memorial University Libraries
St. John's, Newfoundland, A1B 3Y1
+1 709 864-3139

Hello Kathryn,

Thanks for checking in with this. I think this is in reference to the two courses 2030 and 3030: Mathematical Inquiry I and II? These are courses in which the students complete 3-4 projects over the semester. Mostly these will be essentially extended math and/or computing problems. For 2030 I don't think that there should be any issue: it is essentially a renumbered version of the existing 2130 course which has been running for over 30 years. In that course when students do need to look something up (generally syntax for coding or LaTeX) they do it with an internet search: part of the "making use of resources independently" is just them realizing that they can easily search these things on the web. Some projects do have some reading but they are quite targeted and have always been chosen from existing resources (e-books or scientific papers that are already in the library).

3030 will be a more advanced version of 2030. Again the "Inquiry" bit will mainly be mathematical problem solving though there will sometimes also be reference to e-books or scientific papers. That said, it's still only a 3rd year course so we wouldn't be expecting them to conduct extensive research in the literature by themselves. Any problem that we send them looking for information about would be something that the instructor already knows exactly how to solve and where to find information. So I don't anticipate needing anything beyond the existing holds: any requirements would certainly be less than needed for Honours/grad students.

Does that help? If you need more, we could maybe organize a conversation sometime?

Best,
Ivan

Hi Ivan,

Thank you for this explanation. Since we supported the current Applied and Pure Math Majors/Honours degree, we will continue to support the new courses (MATH 2030, MATH 3030 and MATH 409A/B) as needed. If the students of MATH 3030 would benefit from some assistance developing skills searching and accessing ebooks or other literature, the library is more than happy to help. More information can be found on Library and Information Literacy Instruction at https://www.library.mun.ca/usingthelibraries/libraryinstruction/.

Kathryn

RESOURCE IMPLICATIONS

There are no resource implications for this proposal. It will replace existing programs and work with existing courses (except MATH 2030 and 3030 which will replace 2130 and 4190).

ADDITIONAL INFORMATION REQUIRED FOR NEW COURSE PROPOSALS

COURSE DESCRIPTIONS

1) Mathematics 2030 - Mathematical Inquiry I

Course Description: 2030 Mathematical Inquiry I is a course in which students engage in mathematical investigation, and communicate the results of their work in the form of written technical reports and oral presentations. Students will study problems using both analytical methods and computational tools, such as traditional programming languages, computer algebra systems, and other forms of mathematical software.

Pre-requisites: admission to a major offered by the Department of Mathematics and Statistics and MATH 1001 and (Computer Science 1510 or 1001 or 2001, or Engineering 1020; or permission of the Head of Department)

Credit restrictions: MATH 2130
Potential Instructors: Existing Mathematics faculty

Textbook and References: This course is based on independent investigations of topics drawn from across mathematics and its applications and so there is no specific textbook. When appropriate, students will be directed to specific papers from the research literature or online resources for LaTeX and the computational tools. That said, a significant goal of the course is having students learn to find and make use of resources independently.

Tentative Syllabus: This is an independent study, project-based course. Students work on a series of (usually) four mathematical projects, developing their mathematical and problem-solving skills. These are often open-ended encouraging creativity and curiosity-

driven research. After completing their investigation, they will present their results as a technical report and/or a presentation. Particular skills that will be developed include:

1) Problem solving
2) Assimilating and applying mathematics learned in other courses
3) Dealing with large problems: planning and time management
4) Independent research and learning
5) Working in a group and constructive peer critique
6) Using computational tools to supplement analytical reasoning
7) Developing programming skills
8) Learning mathematics-specific software packages including LaTeX and computer algebra (such as Sagemath)
9) Writing a technical report
10) Doing a technical presentation

Evaluation scheme: The mark will typically be based on three or four projects. In four project mode, a typical split is 20%, 20%, 30%, 30%. The marks for the first two projects will usually be based on written reports while those for the last two will usually be split 20%+10% for a written report along with an audio-visual presentation of results. Later projects may involve group work.

Discussion: MATH 2030 is essentially a renamed and renumbered version of the current MATH 2130 that recognizes how it has evolved over the years. The changes have now progressed to the point that it is appropriate to change the course name, number and description. "Technical Writing in Mathematics" is no longer an appropriate name for the course. The material taught is equally important for both "pure" and "applied" mathematics students and focuses on mathematical investigation and the presentation of those results in diverse forms. Hence the second digit in the course number changes from 1 (signifying "applied" math) to 0 (signifying "applied" and "pure").

Over the decades, a large library of projects for 2130 has been developed and most these can simply be ported to 2030. However, some of the more complex ones will be more suited to 3030.

   2) Mathematics 3030 - Mathematical Inquiry II

Course Description: 3030 Mathematical Inquiry II is a continuation of MATH 2030. It builds on, and further refines, the skills developed in that course by exposing students to more complex mathematical investigations which require advanced techniques and more sophisticated approaches.

Pre-requisites: admission to a major offered by the Department of Mathematics and Statistics and MATH 2000, MATH 2030 and MATH 2050.

Potential Instructors: Existing Mathematics faculty

Textbook and References: This course is based on independent investigations of topics drawn from across mathematics and its applications and so there is no specific textbook. When appropriate, students will be directed to specific papers from the research literature or online resources for LaTeX and the computational tools. That said, a significant goal of the course is having students learn to find and make use of resources independently.

Tentative Syllabus: This is an independent study, project-based course. Students work on a series of (usually) three mathematical projects, developing their mathematical and problem-solving skills. These are open-ended encouraging creativity and curiosity-driven research. After completing their investigation, they will present their results as a technical report and/or presentation. Particular skills that will be developed include:

1) Problem solving
2) Assimilating and applying mathematics learned in other courses 3) Dealing with large problems: planning and time management
4) Independent research and learning
5) Working in a group and constructive peer critique
6) Using computational tools to supplement analytical reasoning
7) Developing programming skills
8) Writing a technical report
9) Doing a technical presentation

These skills are essentially the same as those developed in 2030. The goal in this course will be to develop them to a higher level of mastery.

Evaluation scheme: The mark will (usually) be based on three projects. A typical split is 20%, 40%, 40%. The marks for each project will be split about 75%-25% between a written report and presentation of results. Some projects will be group-based.

Discussion: 3030 is a more advanced version of 2030. With the experience from 2030 and stronger math prerequisites, more difficult and involved projects can be tackled. This is also an intended part of the learning process as we want the students to work their way up to handling bigger projects. Having developed the basic skills in 2030, in 3030 they can go directly into handling more difficult projects. The course may include

reading/research projects (learning some new material and then presenting it) as well as the more usual computation/research project from 2030/2130.

MATH 2000 and 2050 are included as pre-requisites to so that we can include projects using multi-variable calculus and linear algebra. MATH 2000 also includes a significant amount of computer algebra which has obvious utility in 3030. There was some consideration to adding other core courses such as MATH 2260, 2320, 3202 or STAT 2410 and indeed most students will probably have done (most) of these before 3030. However, after further consideration it was decided that it is better to avoid complicated pre-requisite structures (especially if they result in students pushing 3030 towards the end of their program).