MEMORIAL UNIVERSITY

Faculty of Science

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

# Meeting of the Faculty Council of the Faculty of Science

A regular meeting of the Faculty Council of the Faculty of Science will be held on Wednesday October 15, 2025 at 1:00pm by WebEx and in-person (Room: C-2045).

## AGENDA

1. Adoption of the Minutes of September 17, 2025 (pages 2-4)
2. Business Arising from the Minutes
3. Reports of Standing Committees:
    A. Undergraduate Students Committee
        a) Department of Physics and Physical Oceanography, new course proposal, Physics 3020 Physics of Energy, Paper 3.A.a. (pages 6-21)
        b) Department of Computer Science, calendar change proposal to Computer Science and Economics Joint Major, Paper 3.A.b. (pages 22-32)
    B. Graduate Studies Committee: no business
    C. Library Committee: no business
4. Report of the Dean
5. Question Period
6. Adjournment

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# FACULTY OF SCIENCE
# FACULTY COUNCIL OF SCIENCE
# Minutes of Meeting of September 17, 2025

A meeting of the Faculty Council of the Faculty of Science was held on Wednesday, September 17, 2025, at 1:00 p.m. using a hybrid model of WebEx and in-person (C-2045).

**FSC 3118 Present**

**Biology**
A. Chaulk, D. Harvey, H. Marshall, M. Rise

**Biochemistry**
M. Berry, V. Booth, E. Clemson, F. Kerton, J. Park, K. Wilson

**Chemistry**
C. Bottaro, H. Grover, M. Katz, F. Kerton, C. Kozak, E. Merschrod, S. Smith, H. Therien-Aubin

**Computer Science**
S. Bungay, A. Fiech, M. Hatcher, M. Hamilton, C. Hyde, T. Wareham

**Mathematics & Statistics**
C. Cigar, D. Dyer, C. Evans, R. Haynes, D. Pike, T. Sheel, S. Sullivan

**Ocean Sciences**
P. Gagnon, J. Wrobewski

**Physics & Physical Oceanography**
D. Coombs, K. Poduska, I. Saika-Voivod, C. Sullivan, L. Zedel

**Psychology**
P. Bitton, S. Blandford, K. Hourihan, C. Quinn-Nilas, C. Thorpe

**Dean of Science Office**
J. Blundell, J. Bowering, J. Ceha, M. Fitzpatrick, T. Fridgen, L. Frizzell, J. Gauld, C. Hussey, G. Jackson, J. Kavanagh, P. MacCallum, V. MacNab, R. Newhook, N. Squires

**Representatives from other Faculties**
B. Misiuk (GEOG)

**Student Representatives**
J. Osbourne, K. Parsons

**FSC 3119 Adoption of Minutes**

**Moved:** Minutes of the meeting of April 16, 2025, be adopted. (*Berry/Wareham*) **Carried**
Abstained: D. Pike, E. Merschrod, T. Wareham

**FSC 3120 Business Arising:** No Business

**FSC 3121 Correspondence:** No Report

**FSC 3122 Reports of Standing Committees**:

**A. Undergraduate Studies Committee**: No Business

**B. Graduate Studies Committee:**

Presented by Adrian Fiech, Chair of the Graduate Studies Committee

a) Department of Computer Science, Calendar changes, PhD in Computer Science
(*Fiech, Bungay*) **Carried.**

b) Department of Physics and Physical Oceanography, Special Topics Course, PHYS 6913: Graduate Introduction to Stellar Astrophysics, approved by the Faculty of Science Graduate Committee and presented to Faculty Council for information only.

**C. Library Committee:** No Business

**FSC 3124 Committee Matrix**

The updated Faculty of Science Faculty Council matrix for 2025-2026 is updated online. There are several vacant positions available. To volunteer for these positions, please contact your Head of Department or email deansciassistant@mun.ca.

**FSC 3124 Dean's Report**

The welcome back and Everything Science event, which consisted of departmental engagement and student focus groups, was successful. If you have any feedback on the event, please send it along to the Dean's Office.

Employee town hall on September 24, 2025, was announced. All Faculty and Staff are encouraged to attend.

The Dean of Science Awards will be held on Wednesday, October 1 at 5:00. All Faculty and Staff are encouraged to attend to support the wonderful achievements of our faculty, staff and students.

Congratulations to M. Berry on the well attended and organized event.

**FSC 3125 Questions**

M. Rise asked to have the terms of reference of Faculty Council circulated.

E. Merschrod raised concerns about the Faculty of Science IT support, specifically the removal of OCIOs live chat for IT support, the Dean advised E. Merschrod that he would look further into the process.

M. Berry asked for more information regarding an email sent to Head's regarding the course load waivers forms. S. Sullivan explained the process and assured council more input regarding these forms will be sent out.

**FSC 3126 Adjournment:**

Meeting adjourned at 1:21 p.m.

MEMORIAL UNIVERSITY

Faculty of Science

Faculty of Science Undergraduate Committee (FoScUgs)
Memorial University, St. John's NL A1B 3X7
Tel: 709.864.8253
www.mun.ca

October 8, 2025

To: Deansciassistant, Secretary – Faculty Council
From: Melanie, Secretary - FOSCUGS
Subject: Transmittal of calendar changes

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Please see attached documents for inclusion in the next Faculty Council meeting. Advise any questions.

UCCPF – New Course – Physics 3020 Physics of Energy

Calendar Change Proposal - Computer Science and Economics Joint Major

Melanie Fitzpatrick
Secretary
Faculty of Science Undergraduate Committee (FoScUgs)

# 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:

- **x** New course: **Physics 3020 Physics of Energy**
- ☐ 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**
PHYS 3020 Physics of Energy

**ABBREVIATED COURSE TITLE**
Physics of Energy

**RATIONALE**

Energy is a fundamental aspect of our life. As the energy sector continues to evolve, there is a growing demand for professionals with expertise in energy technologies. The course "Physics of Energy" aims to provide students with a comprehensive understanding of how energy is generated, transmitted, and stored, with a focus on practical applications and real-world relevance. In this course, students will gain a solid foundation in the principles of energy generation, transmission, and storage. The course covers a wide range of topics, including mechanical motion, thermodynamics, nuclear processes, semiconductor physics, power transmission, and energy storage technologies. Students will also learn about the environmental implications of different energy technologies and explore innovative solutions for reducing carbon footprints. This course provides students with the knowledge and skills necessary to pursue careers in energy engineering, renewable energy, power generation, and related fields.

Preliminary discussion with the Department of Electrical and Computer Engineering has indicated that this proposed course might be used by ECE undergraduates as a technical elective.

The course complements our plans for a co-operative internship option for Physics students. This course would be useful for students seeking work placements in the energy generation, transmission and storage sectors.

**ANTICIPATED EFFECTIVE DATE**

Fall 2026

## CALENDAR CHANGES

13.11 Physics and Physical Oceanography

PHYS 3020 Physics of Energy

provides a comprehensive overview of the principles and technologies involved in the generation, transmission, and storage of electrical energy. Topics include mechanical, thermal, nuclear, and light-based energy conversion, as well as the fundamentals of energy transmission and storage.

PR: any two of PHYS 2053, 2055, and 2750; or PHYS 3000

## CALENDAR ENTRY AFTER CHANGES

13.11 Physics and Physical Oceanography

PHYS 3020 Physics of Energy

provides a comprehensive overview of the principles and technologies involved in the generation, transmission, and storage of electrical energy. Topics include mechanical, thermal, nuclear, and light-based energy conversion, as well as the fundamentals of energy transmission and storage.

PR: any two of PHYS 2053, 2055, and 2750; or PHYS 3000

# Memorial University of Newfoundland
# Undergraduate Calendar Change Proposal Form
# Appendix Page

**CONSULTATIONS SOUGHT**

**Consultation email**

**From:** Saika-Voivod, Ivan <saika@mun.ca>
**Sent:** Thursday, September 11, 2025 9:54 AM
**To:** assocdeancphss <assocdeancphss@mun.ca>; Business Undergrad Help <busihelp@mun.ca>; Dean of Education <educdean@mun.ca>; Engineering and Applied Science <engrconsult@mun.ca>; HKR Dean <hkrdean@mun.ca>; Dean of Medicine : McKeen, Dr. Dolores <deanofmedicine@mun.ca>; Karen Bulmer <kbulmer@mun.ca>; DeanNurse <DeanNurse@mun.ca>; Pharmacy <pharminfo@mun.ca>; Dean of Science <deansci@mun.ca>; adeanugradswk <adeanugradswk@mun.ca>; Dean of Arts and Social Science (Grenfell Campus) <gcsass-dean@mun.ca>; GC School of Science and the Environment <gcsse@mun.ca>; GC School of Fine Arts <gcsofa@mun.ca>; Marine Institute <miugconsultations@mi.mun.ca>; deanofsass <deanofsass@mun.ca>
**Subject:** Physics of Energy new course - Consultation Request

The Department of Physics and Physical Oceanography is soliciting feedback on a proposal for a new course, Physics 3020 Physics of Energy.

In this course, students will gain a solid foundation in the principles of energy generation, transmission, and storage. The course covers a wide range of topics, including mechanical motion, thermodynamics, nuclear processes, semiconductor physics, power transmission, and energy storage technologies.

Please send comments to Ivan Saika-Voivod at saika@mun.ca.

Thank you,

Ivan Saika-Voivod, Professor
Deputy Head (Undergraduate Studies)
Department of Physics and Physical Oceanography, Memorial University of Newfoundland
Tel: 709-864-8886, Fax: 709-864-8739, Rm C3026, http://www.physics.mun.ca/~saika/

| **Academic Unit** | **Response Received** |
|---|---|
| Humanities and Social Sciences | Sept. 13, 2025 |
| Business Administration | nr |
| Education | nr |
| Engineering and Applied Science | Sept. 17, 2025 |
| Human Kinetics and Recreation | nr |
| Marine Institute | nr |
| Medicine | nr |
| Music | nr |
| Nursing | Sept. 11, 2025 |
| Pharmacy | nr |
| Science | Sept. 12, 2025 |
| Biochemistry | Sept. 22, 2025 |
| Biology | nr |
| Chemistry | nr |
| Computer Science | Sept. 11, 2025 |
| Earth Sciences | nr |
| Mathematics and Statistics | nr |
| Ocean Sciences | nr |
| Physics and Physical Oceanography | na |
| Psychology | nr |
| Social Work | nr |
| Library | Report recv’d Sept. 15, 2025 |
| Grenfell - Arts and Social Science | nr |
| Grenfell - Science and the Environment | nr |

| Academic Unit | Response Received |
|---|---|
| Grenfell - Fine Arts | nr |
| Labrador Institute | nr |

**Responses**

**Nursing**

**From:** DeanNurse <DeanNurse@mun.ca>
**Date:** Thursday, September 11, 2025 at 10:34 AM
**To:** Saika-Voivod, Ivan <saika@mun.ca>
**Subject:** RE: Physics of Energy new course - Consultation Request
Good morning, Dr. Saika-Voivod.

Dr. April Pike, our dean at the Faculty of Nursing, has reviewed your consultation request. She tells me that she sees no implications for our Faculty of Nursing.

Thank you for your time. Wishing you a great day, today!
Jane

**Computer Science**

**From:** Saika-Voivod, Ivan <saika@mun.ca>
**Date:** Thursday, September 11, 2025 at 11:59 AM
**To:** Hyde, Cathy <cathy@mun.ca>
**Subject:** Re: Physics of Energy new course - Consultation Request
Hi Cathy,

Thank you for your feedback; you raise an excellent point. We will likely be embarking on a curriculum review this year, and this is the kind of thing that we need to consider.

Best,
Ivan

Ivan Saika-Voivod, Professor
Deputy Head (Undergraduate Studies)
Department of Physics and Physical Oceanography, Memorial University of Newfoundland
Tel: 709-864-8886, Fax: 709-864-8739, Rm C3026, http://www.physics.mun.ca/~saika/

**From:** Hyde, Cathy <cathy@mun.ca>
**Date:** Thursday, September 11, 2025 at 11:18 AM
**To:** Saika-Voivod, Ivan <saika@mun.ca>
**Subject:** RE: Physics of Energy new course - Consultation Request
Hi Ivan,

Sounds like a great course. It looks to me like joint CS-Physics majors will be able to take it however, I don't think there is any space in the joint CS-Physics honours program since the only optional Physics course is at the 4000 level. I don't think this is necessarily an issue, I am just noting it. If we find that our joint honours students are interested in the course then we may want to consider updating the physics course requirements in future. What are your thoughts?

. . . . . .

Cathy Hyde, MSc | Manager of Academic Programs, MSc

Department of Computer Science
Memorial University of Newfoundland
220 Prince Philip Drive, St. John's, NL, A1C 5S7
www.mun.ca/computerscience/

**Dean of Science Office**

**From:** Fridgen,Travis <tfridgen@mun.ca>
**Date:** Friday, September 12, 2025 at 7:59 AM
**To:** Saika-Voivod, Ivan <saika@mun.ca>
**Subject:** FW: Physics of Energy new course - Consultation Request
Hi Ivan,

Very nice, this looks like a very interesting course and one that could prove to be very popular!

Best,
Travis

**DR. TRAVIS FRIDGEN HBSc, BEd, PhD (he/him)**
**ASSOCIATE DEAN OF SCIENCE**
Professor of Chemistry
Memorial University

St. John's, NL , Canada A1B 3X7
T 709-864-8153
**https://www.mun.ca/faculty/tfridgen**
https://mun.webex.com/meet/tfridgen

*The lands on which Memorial's campuses are situated are in the traditional territories of diverse Indigenous groups, and we acknowledge with respect the diverse histories and cultures of the Beothuk, Mi'kmaq, Innu, and Inuit of this province.*

**HSS Dean's Office**

**From:** assocdeancphss <assocdeancphss@mun.ca>
**Date:** Saturday, September 13, 2025 at 7:36 AM
**To:** Saika-Voivod, Ivan <saika@mun.ca>
**Subject:** Re: Physics of Energy new course - Consultation Request

Looks like a great addition to the Physics program! No concerns from HSS.

P. Dold
Associate Dean, HSS

**Faculty of Engineering and Applied Science**

**From:** Engineering Consult <engrconsult@mun.ca>
**Date:** Wednesday, September 17, 2025 at 2:49 PM
**To:** Saika-Voivod, Ivan <saika@mun.ca>
**Cc:** Edmunds, Jayde <edmundsj@mun.ca>, Masek, Vlastimil <masek@mun.ca>, Adam Noel <adam.noel@mun.ca>
**Subject:** Re: Physics of Energy new course - Consultation Request
Thank you for the opportunity to comment on the proposed new course "Physics 3020 Physics of Energy".

At its meeting on Sep. 17, the Committee on Undergraduate Studies for the Faculty of Engineering and Applied Science noted that some of our students might be interested in this course as a technical elective or free elective. There is no other impact on our programs. We are happy to support this new course.

Yours sincerely,

Dr. Glyn George, Chair

Committee on Undergraduate Studies
Faculty of Engineering and Applied Science
Memorial University of Newfoundland
St. John's NL A1B 3X5
---

**Biochemistry**

**From:** Saika-Voivod, Ivan <saika@mun.ca>
**Date:** Tuesday, September 23, 2025 at 8:49 AM
**To:** Harding, Scott <sharding@mun.ca>
**Subject:** Re: Physics of Energy course proposal feedback
Good morning, Scott.

Thank you for your comments and for catching that slip in the prerequisites listing, which I will fix.

Best regards,
Ivan

Ivan Saika-Voivod, Professor
Deputy Head (Undergraduate Studies)
Department of Physics and Physical Oceanography, Memorial University of Newfoundland
Tel: 709-864-8886, Fax: 709-864-8739, Rm C3026, http://www.physics.mun.ca/~saika/

**From:** Harding, Scott <sharding@mun.ca>
**Date:** Monday, September 22, 2025 at 11:17 PM
**To:** Saika-Voivod, Ivan <saika@mun.ca>
**Subject:** Physics of Energy course proposal feedback
Hi Ivan,
The only minor comment I have on this package is the wording on the prerequisites line of the calendar entry. Should it be: "any two of PHYS 2053, 2750 and 2055; or PHYS 3000. Probably irrelevant given the new formatting of the calendar. The course looks interesting and well supported by the number of other physics departments offering a similar course.

All the best,
Scott
--
Scott Harding, PhD
Associate Professor

Deputy Head | Undergraduate Studies
Department of Human Biosciences | Memorial University
T. 709.864.8539 | CSF-3235

**LIBRARY REPORT:**

**From:** Saika-Voivod, Ivan <saika@mun.ca>
**Date:** Thursday, September 11, 2025 at 9:03 AM
**To:** University Librarian <univlib@mun.ca>
**Subject:** New course Physics 3020 report request

Dear Library,

The Department of Physics and Physical Oceanography is requesting a library report for a new course proposal, Physics 3020 Physics of Energy, attached.

The proposed required text for the course is R.L. Jaffe and W. Taylor, *The Physics of Energy* (Cambridge Univ. Press, 2018).

Thank you,
Ivan

Ivan Saika-Voivod, Professor
Deputy Head (Undergraduate Studies)
Department of Physics and Physical Oceanography, Memorial University of Newfoundland
Tel: 709-864-8886, Fax: 709-864-8739, Rm C3026, http://www.physics.mun.ca/~saika/

**From:** Saika-Voivod, Ivan <saika@mun.ca>
**Date:** Monday, September 15, 2025 at 10:41 AM
**To:** Rose, Kathryn <kathrynr@mun.ca>
**Subject:** Re: New course Physics 3020 report request
Thank you very much, Kathryn. Much appreciated. I am happy that the library has sufficient resources to support the proposed Physics of Energy course.

Best regards,
Ivan

Ivan Saika-Voivod, Professor

Deputy Head (Undergraduate Studies)
Department of Physics and Physical Oceanography, Memorial University of Newfoundland
Tel: 709-864-8886, Fax: 709-864-8739, Rm C3026, http://www.physics.mun.ca/~saika/

**From:** Rose, Kathryn <kathrynr@mun.ca>
**Date:** Monday, September 15, 2025 at 10:05 AM
**To:** Saika-Voivod, Ivan <saika@mun.ca>
**Subject:** Fw: New course Physics 3020 report request
Good Morning Ivan,

You'll find the library report for 3020 attached here.

I just wanted to let you know that while the library doesn't currently have the textbook, we should be able to find a physical copy. Unfortunately, we won't be able to locate an electronic copy as the publisher hasn't made any electronic licenses available for library purchase.

Kathryn

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**From:** University Librarian <univlib@mun.ca>
**Sent:** September 11, 2025 11:06 AM
**To:** Rose, Kathryn <kathrynr@mun.ca>
**Subject:** FW: New course Physics 3020 report request

SHERI COOMBS MA | Decanal Assistant
Memorial University Libraries
L-2019A Queen Elizabeth II Library
Memorial University | St. John's | Newfoundland | A1B 3Y1
T: 709.864.3862
E: sheri.coombs@mun.ca
www.library.mun.ca

Library report follows on next page.

Collections Strategies
Queen Elizabeth II Library

To: Dr. M. Evstigneev
From: Dr. Kathryn Rose, Head, Collections Strategies
Subject: New Course Proposal: Physics 3020 Physics of Energy Conservation
Date: September 15, 2025

---

Upon review of the new course proposal for Physics 3xxx Physics of Energy Conversation, I have determined that Memorial University Libraries has sufficient resources to support the objectives of this course.

There is only one textbook listed for this course, and while we do not currently have this title in our collection, it is not particularly expensive and should be easily purchased in a physical format. However, it should be noted that this resource has been defined as a textbook by the publisher, and as such, there are limited modes of acquisition for the library. There are no electronic licensing options available to the library for this title.

A closer look at the subject areas covered in the course syllabus shows ample coverage in the collection. The following table shows a select of relevant subject areas:

| **Subject Area** | **Number of Titles in Catalogue** |
|---|---|
| | |
| Electromagnetic Induction | 29 |
| Wind Turbines | 153 |
| Hydroelectric power plants | 860 |
| Thermodynamics | 2,852 |
| Geothermal resources | 202 |
| Internal combustion engines | 186 |
| Solar Thermal Energy | 91 |
| Nuclear fission | 65 |
| Photovoltaic cells | 118 |
| Solar Energy | 774 |
| Electric power transmission | 521 |
| High voltage direct current | 8 |
| Electric machinery – alternating current | 21 |
| Power Grid | 14 |

| | |
|---|---|
| Electric power transmission – reliability | 8 |
| Distributed generation of electric power | 64 |
| Energy storage | 815 |
| Smart power grids | 347 |
| Supercapacitors | 50 |

The collection also contains numerous databases and indexes to help with the discovery of scholarly literature, if required. Additional resources may be purchased as needed under existing budget allocations. The University also has excellent document delivery services which will, upon request, assist faculty, staff and student access resources that are not available locally.

## RESOURCE IMPLICATIONS:

The proposed course would be included as one of the elective courses offered by the department on a rotating basis influenced by student demand. As such, no new resources are required. There is no lab component.

## ADDITIONAL INFORMATION REQUIRED FOR NEW COURSE PROPOSALS

Instructor: Mykhaylo Evstigneev is developing this course, but the course could be taught by any ASM within the Department of Physics and Physical Oceanography.

**Text:** R.L. Jaffe and W. Taylor. *The Physics of Energy* (Cambridge Univ. Press, 2018)

**Method of Evaluation**

| | |
|---|---|
| Homework assignments (weekly) | 10% |
| Mid-term test 1 | 20% |
| Mid-term test 2 | 20% |
| Final exam | 50% |

**Course Outline**

**Electrical Energy from Mechanical Motion:** Principles of electromagnetic induction. Design and operation of wind turbines. Hydroelectric power: dams, tidal, and wave energy.

**Electrical Energy from Heat:** Thermodynamics and heat engines. Coal, natural gas, and geothermal power plants. Solar thermal power plants. Internal combustion engines. Efficiency and environmental impact of thermal energy conversion.

**Electrical Energy from Fission and Fusion:** Mass-energy conversion. Liquid drop model. Nuclear fission: reactors, fuel cycles, and waste management. Basics of nuclear fusion and future potential.

**Electrical Energy from Light:** Basic semiconductor physics. Photovoltaic cells. Solar energy efficiency. Advances in solar energy technologies.

**Energy Transmission:** Basics of power transmission. High-voltage direct current and alternating current systems. Grid infrastructure and smart grids. Transmission losses and efficiency. Distribution networks and substations.

**Energy Storage Technologies:** Types of energy storage: pumped hydro, compressed air, flywheels, and supercapacitors. Emerging storage technologies: hydrogen and thermal storage. Battery fundamentals: types, chemistry, and performance

## Sample Assignment

**Physics 3xxx** **Sample problem set**
**Physics of Energy Conversion** **M. Evstigneev**
**Winter 2026**

**Problem 1**

A beam of particles with flux $\Phi$ is incident on a uniform target of thickness $T$ and mass density $\rho$. Assuming that the atoms in the target do not block one another, show that the reaction rate is given by $dN/dt = I\sigma\rho N_A T/m$, where $I$ is the beam current (= integral of flux over the area of the beam), $m$ is the molecular mass of the target, $N_A$ the Avogadro number, and $\sigma$ the reaction cross section.

**Problem 2**

A typical fission reaction involving $^{235}$U is

$$^{235}_{92}\mathrm{U} + n \rightarrow ^{144}_{56}\mathrm{Ba} + ^{90}_{36}\mathrm{Kr} + 2n$$

with the kinetic energy of the thermal neutrons $\approx 25\,\mathrm{meV}$ practically negligible. Find the energy released in this reaction.

**Problem 3**

A beam of thermal neutrons with current $I = 10^8\,\mathrm{s}^{-1}$ is incident on a uniform thin target of thickness 1 cm, consisting of 20 % $^{235}$U and 80 % $^{238}$U. What is the fission rate? What is the thermal power being deposited in the target?

**Problem 4**

Estimate the number of neutrons emitted by spontaneous fission per second per kilogram of naturally occurring uranium.

**List of similar courses taught elsewhere**

University of Calgary: PHYS371 Introduction to Energy
https://calendar.ucalgary.ca/courses/1616611

- No prerequisites. Taught as a Science elective for non-Science students.
- Our course would be taught as a third-year Physics course with incumbent prerequisites.

University of Regina: PHYS140 Physics of Energy and the Environment
https://www.coursicle.com/ureginaca/courses/PHYS/140/

- "Semi-quantitative" course with no prior physics background required, similar to U of C offering

MIT: OpenCourseWare 8.21 The Physics of Energy
https://ocw.mit.edu/courses/8-21-the-physics-of-energy-fall-2009/

- Prerequisites are
  - *Physics*: Physics I Classical Mechanics (8.01) and Physics II: Electricity and Magnetism (8.02)
  - *Mathematics*: Single Variable Calculus (18.01) and Multivariable Calculus (18.02)
  - *Chemistry*: Principles of Chemical Science (5.111 and 5.112) or Introduction to Solid State Chemistry (3.091)
- "The course is designed for MIT sophomores, juniors, and seniors who want to understand the fundamental laws and physical processes that govern the sources, extraction, transmission, storage, degradation, and end uses of energy."
- Instructors are the authors of the textbook for our proposed course. Our offering would be similar to this one.

University of Manchester: PHYS 10622 Physics of Energy Sources
https://documents.manchester.ac.uk/display.aspx?DocID=51409

- Prerequisites include
  - PHYS10071 Mathematics 1 [calculus, linear algebra, differential equations]
  - PHYS10121 Quantum Physics and Relativity [looks like our PHYS 2750]
- Also uses the Jaffe and Taylor textbook

# Memorial University of Newfoundland
# Undergraduate Calendar Change Proposal Form
# Cover Page

**LIST OF CHANGES**

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

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

**ADMINISTRATIVE AUTHORIZATION**

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

Signature of Dean/Vice-President: _____

Date: _____

Date of approval by Faculty/Academic Council: _____

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

**PROGRAM TITLE**
Computer Science and Economics Joint Major

**RATIONALE**

We are proposing some changes to the Computer Science courses required for this program.

1. COMP 2500-Data Analysis with Scripting Languages has not been offered in several years and is unlikely to be offered again anytime soon. We are proposing to switch this course for COMP 3400-Data Preparation Techniques.

2. COMP 3731 and COMP 3753 have are both required courses for the program, neither have been offered in several years and it is unlikely either will be offered again anytime soon. We are proposing to replace COMP 3731 and 3753 with 6 further credit hours (unspecified) in Computer Science courses at the 3000-level or higher (COMP 3401 recommended).

3. Right now students can graduate with this degree without having taken a 4000-level CS course. We are proposing a change that would require students to complete at least one 4000-level course.

**ANTICIPATED EFFECTIVE DATE**
Fall 2026

**CALENDAR CHANGES**
10.1.4 Computer Science and Economics Joint Major
As a component of the Degree Regulations for the General Degree of Bachelor of Science, the following courses are required:

1. Computer Science Requirements

Forty-two credit hours in Computer Science courses are required for the Joint Major in Computer Science and Economics:

a. Computer Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, ~~2500, 3731, 3753~~, 3400

b. 12 credit hours in Computer Science courses at the 3000-level or higher, of which at least 3 credit hours must be at the 4000-level. (Computer Science 3401 is recommended).

~~c. Six additional credit hours in Computer Science courses numbered 3000 or higher.~~

2. Economics requirements

Forty-two credit hours in Economics courses are required for the Joint Major in Economics and Computer Science:

a. Economics 1010 (or the former 2010), 1020 (or the former 2020), 2550, 3000, 3001, 3010;
b. Six credit hours from either 3550 and 3551, or 4550 and 4551;
c. The remaining 18 credit hours shall be chosen from among the various Economics courses in consultation with the Head of the Department or delegate, and will include at least 9 credit hours in courses at the 4000 level.

3. Additional Requirements

Mathematics 1000, 1001, 2000, 2050, and Statistics 2500 or 2550.

## CALENDAR ENTRY AFTER CHANGES

10.1.4 Computer Science and Economics Joint Major

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

1. Computer Science Requirements

Forty-two credit hours in Computer Science courses are required for the Joint Major in Computer Science and Economics:

a. Computer Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 3400
b. 12 credit hours in Computer Science courses at the 3000-level or higher, of which at least 3 credit hours must be at the 4000-level. (Computer Science 3401 is recommended).

2. Economics requirements

Forty-two credit hours in Economics courses are required for the Joint Major in Economics and Computer Science:

a. Economics 1010 (or the former 2010), 1020 (or the former 2020), 2550, 3000, 3001, 3010;
b. Six credit hours from either 3550 and 3551, or 4550 and 4551;
c. The remaining 18 credit hours shall be chosen from among the various Economics courses in consultation with the Head of the Department or delegate, and will include at least 9 credit hours in courses at the 4000 level.

3. Additional Requirements

Mathematics 1000, 1001, 2000, 2050, and Statistics 2500 or 2550.

## SECONDARY CALENDAR CHANGES

No secondary changes.

# Memorial University of Newfoundland
# Undergraduate Calendar Change Proposal Form
# Appendix Page

## CONSULTATIONS SOUGHT

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|---|
| Academic Advising Centre |
| Humanities and Social Sciences—Economics supports change |
| 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—no impact on Library's collections |
| Marine Institute |
| Medicine |
| Music |
| Nursing |
| Pharmacy |
| Social Work |
| Science |
| • Biochemistry |
| • Biology |
| • Chemistry |
| • Earth Sciences |
| • Geography |
| • Mathematics and Statistics |
| • Ocean Sciences |
| • Physics and Physical Oceanography |
| • Psychology |

***ECONOMICS:***

**From:** Messacar, Derek <dmessacar@mun.ca>
**Sent:** Saturday, February 8, 2025 11:12 PM
**To:** Hyde, Cathy <cathy@mun.ca>
**Subject:** RE: CS-Economics joint program

Hi Cathy,

Thank you again for sending this to me for feedback. My reaction is the same as Lynn's. You are only proposing changes to the CS requirements and no change to the total number of CS credit hours so it all seems fine with me. The only comment I do have is that you are replacing 2500 (2nd-year) with 3400 (3rd-year) so increasing the program difficulty a bit. I suggest revising this in a way that is comparable to what you are doing for your other programs and joint programs that currently require 2500.

There is a Departmental meeting this coming Friday, February 14th so I will raise this as an issue for comment at that time. I will keep you posted.

—DM

**From:** Hyde, Cathy <cathy@mun.ca>
**Sent:** Wednesday, February 5, 2025 11:36 AM
**To:** Messacar, Derek <dmessacar@mun.ca>
**Subject:** RE: CS-Economics joint program

That sounds great, thanks!

. . . . . .

Cathy Hyde, MSc | Manager of Academic Programs, MSc

Department of Computer Science
Memorial University of Newfoundland
220 Prince Philip Drive, St. John's, NL, A1C 5S7
www.mun.ca/computerscience/

**From:** Messacar, Derek <dmessacar@mun.ca>
**Sent:** Wednesday, February 5, 2025 11:34 AM
**To:** Hyde, Cathy <cathy@mun.ca>
**Cc:** Economics Dept <economics@mun.ca>
**Subject:** RE: CS-Economics joint program

Hi Cathy,

Thanks for sending this to me. I am the right person. I will look through it and get back to you shortly.

—DM

**From:** Hyde, Cathy <cathy@mun.ca>
**Sent:** Wednesday, February 5, 2025 11:28 AM
**To:** Messacar, Derek <dmessacar@mun.ca>; Economics Dept <economics@mun.ca>
**Subject:** FW: CS-Economics joint program

Hi,

Last year Lynn Gambin and I were discussing changes to the required CS courses for the CS-Economics joint program (see below). We didn't get the calendar change proposal ready in time for this year's calendar change process and we are working on putting the change through now. Before I bring the changes forward to my department I wanted to check in to make sure nothing had changed. I had planned to check in with Lynn however, I see that she is on sabbatical. If there someone else I should direct this to please let me know. Thanks,

. . . . . .

Cathy Hyde, MSc | Manager of Academic Programs, MSc

Department of Computer Science
Memorial University of Newfoundland
220 Prince Philip Drive, St. John's, NL, A1C 5S7
www.mun.ca/computerscience/

**From:** Gambin, Lynn <lynn.gambin@mun.ca>
**Sent:** Thursday, March 7, 2024 12:10 PM
**To:** Cathy Hyde <cs-ugradadv@mun.ca>
**Cc:** Economics Dept <economics@mun.ca>
**Subject:** RE: CS-Economics joint program

Hi Cathy,

Thanks for consulting with us on these potential changes. My main view is that the joint CS-economics program should align with each separate major as far as possible to ensure their program reflects what would be expected of someone who holds specialization in the two subjects. If the substitution of the specific CS courses seems best for the overall package of courses on the CS side of the joint program then I'm in agreement with your suggestions. Just a couple of comments:

1. COMP 2500-Data Analysis with Scripting Languages is a required course for the program but we haven't offered this course in several years and it is unlikely we will offer it anytime soon. We suggest COMP 3400-Data Preparation Techniques as a substitute. What are your thoughts? *Data preparation seems like it would be a good complement to studies in economics, especially techniques of data mining and pre-processing large datasets.*

2. COMP 3731 is a required course for the program but we haven't offered this course in several years and it is unlikely we will offer it anytime soon. We suggest instead replacing 3731 with 3 further credit hours (unspecified) in Computer Science courses (COMP 3400 or 3401 is recommended). What are your thoughts?*3401 looks really interesting and again, a good fit for someone also studying economics.*

3. COMP 3753 is a required course for the program but we haven't offered this course in several years and it is unlikely we will offer it anytime soon. We suggest instead replacing 3753 with 3 further credit hours (unspecified) in Computer Science courses. What are your thoughts? *I would agree with this. Allows the student to look more into an area that they find interesting and likely to be of use for their particular plans.*

a. Right now students can graduate with this degree without having taken a 4000-level CS course. We would like to make a change requiring students to complete at least one 4000-level course. We propose to change regulation 10.1.4.1.b "Six additional credit hours in Computer Science courses numbered 3000 or higher." To be "3 further credit hours in a 4000-level Computer Science course, plus 3 further credit hours at the 3000 level or higher."
What are your thoughts on this? *I would endorse the addition of this requirement for at least 3 credit hours at the 4000-level. Looking at some of the offerings you have, 4304 (data visualization) looks like it would be particularly useful for economics students (even those not doing the joint program!). 4754 (database systems) is another I'd expect some would be interested in. But again, I think the main thing on having the 4000-level requirement is to be sure that the joint program aligns well with a CS program that's robust and gives a balance of breadth and depth to the student.*

Best wishes,
Lynn

Lynn Gambin, PhD
Director of Undergraduate Programs, Economics Department
Coordinator, Economics Co-operative Education Option (ECEO)

Associate Professor
Department of Economics
Faculty of Humanities & Social Sciences
Memorial University of Newfoundland

Room AA3085, Arts & Administration Building
St. John's, NL, Canada, A1C 5S7

Email: lynn.gambin@mun.ca
Twitter@LynnGambin
LinkedIn
Google Site

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**From:** Cathy Hyde <cs-ugradadv@mun.ca>
**Sent:** February 19, 2024 11:41 AM
**To:** Economics Dept; nlysenko@mun.ca
**Subject:** CS-Economics joint program

Hi,

Our undergraduate studies committee met recently to discuss some of our joint programs and we had some suggestions for the joint CS-Economics program.

1. COMP 2500-Data Analysis with Scripting Languages is a required course for the program but we haven't offered this course in several years and it is unlikely we will offer it anytime soon. We suggest COMP 3400-Data Preparation Techniques as a substitute. What are your thoughts?

2. COMP 3731 is a required course for the program but we haven't offered this course in several years and it is unlikely we will offer it anytime soon. We suggest instead replacing 3731 with 3 further credit hours (unspecified) in Computer Science courses (COMP 3400 or 3401 is recommended). What are your thoughts?
3. COMP 3753 is a required course for the program but we haven't offered this course in several years and it is unlikely we will offer it anytime soon. We suggest instead replacing 3753 with 3 further credit hours (unspecified) in Computer Science courses. What are your thoughts?

a. Right now students can graduate with this degree without having taken a 4000-level CS course. We would like to make a change requiring students to complete at least one 4000-level course. We propose to change regulation 10.1.4.1.b "Six additional credit hours in Computer Science courses numbered 3000 or higher." To be "3 further credit hours in a 4000-level Computer Science course, plus 3 further credit hours at the 3000 level or higher."

What are your thoughts on this?

Thanks,

. . . . . .

Cathy Hyde, MSc | Manager of Academic Programs, MSc

Department of Computer Science
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220 Prince Philip Drive, St. John's, NL, A1C 5S7
www.mun.ca/computerscience/

***LIBRARY:***

**From:** Rose, Kathryn <kathrynr@mun.ca>
**Sent:** Monday, September 15, 2025 8:43 AM
**To:** cs-ugradadv@mun.ca
**Subject:** Fw: Calendar change proposals for Computer Science

Good Morning Cathy,

These changes will have no impact on the library's collections. We will continue to support students and faculty as required through existing allocations.

Kathryn

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**From:** University Librarian <univlib@mun.ca>
**Sent:** September 10, 2025 12:20 PM
**To:** Rose, Kathryn <kathrynr@mun.ca>
**Subject:** FW: Calendar change proposals for Computer Science

SHERI COOMBS MA | Decanal Assistant
Memorial University Libraries
L-2019A Queen Elizabeth II Library
Memorial University | St. John's | Newfoundland | A1B 3Y1
T: 709.864.3862
E: sheri.coombs@mun.ca
www.library.mun.ca

**From:** Cathy Hyde <cs-ugradadv@mun.ca>
**Sent:** Wednesday, September 10, 2025 12:06 PM
**To:** University Librarian <univlib@mun.ca>
**Subject:** Calendar change proposals for Computer Science

Hi,

I've attached to calendar change proposals for the Department of Computer Science. The first is for a change to our joint CS-Economics program – we are looking to change the course requirements on the CS side. The second is a change to our Computer Science Internship program – we are looking to include a 4000-level CS course as a required course after the internship is complete. Please let me know if you have any concerns. Thanks,

. . . . . .

Cathy Hyde, MSc | Manager of Academic Programs, MSc

Department of Computer Science
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220 Prince Philip Drive, St. John's, NL, A1C 5S7
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**LIBRARY REPORT**
NA

**RESOURCE IMPLICATIONS**
No impact on resources since newly required course is already a regular offering.