SFU GRADUATE STUDIES

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**MEMORANDUM**

ATTENTION Senate

DATE January 14, 2025

FROM Mary O'Brien,
Chair of Senate Graduate Studies Committee (SGSC)

RE: New Courses

**For information:**

Acting under delegated authority at its meeting of **January 7, 2025**, SGSC approved the following new course(s), effective **Fall 2025**:

**Faculty of Applied Sciences**

School of Computing Science

1) New Course: CMPT 776 Quantum Algorithms

**Faculty of Arts and Social Sciences**

Department of French

1)New Course: FREN 891 Directed Readings in French Literature and/or Linguistics

School for International Studies

**2)** New Course: IS 804 Approaches to International Studies

**Faculty of Science**

Department of Mathematics

1)New Course: MATH 776 Quantum Computation

Senators wishing to consult a more detailed report of curriculum revisions may do so on the Senate Docushare repository at https://docushare.sfu.ca/dsweb/View/Collection-12682

OFFICE OF THE DEAN
Faculty of Applied Sciences
Simon Fraser University

MEMORANDUM

| | | |
|---|---|---|
| Attention | Dr. Mary O'Brien<br>Dean, Graduate Studies | Nov 20, 2024 |
| From | Dr. Parvaneh Saeedi, psaeedi@sfu.ca<br>Faculty of Applied Science, Graduate Studies Committee | |

Re: FAS-CMPT 776 – New course proposal

The Faculty of Applied Sciences Graduate Studies Committee would like to propose a new graduate course effective Fall 2025 – CMPT 776 Quantum Algorithms. This course will be cross-listed with CMPT 476. The course will be offered once every two years, alternating years with MATH 776.

This course introduces the field of quantum computing, emphasizing the development and application of quantum algorithms. Topics covered include the foundations of quantum information and computation, along with seminal quantum algorithms. By leveraging the principles of quantum mechanics, quantum algorithms solve certain problems more efficiently than classical methods.

We request this course to become effective from Fall 2025.

Best Regards,

Parvaneh Saeedi,
Faculty of Applied Science, Graduate Studies Committee

SFU

COMPUTING SCIENCE

MEMO

BURNABY
10700 Applied Sciences Building
8888 University Drive
Burnaby BC V5A 1S6
Canada

SURREY
250-13450 102 Avenue
Surrey, BC V3T 0A3
Canada

Tel: 778-782-4277
Fax: 778-782-3045
Web: www.cs.sfu.ca

| | |
|---|---|
| ATTENTION Error! Bookmark not defined. | Dr. Parvaneh Saeedi<br>Associate Dean, Research & Graduate Studies, FAS |
| FROM | Dr. Manolis Savva<br>School of Computing Science GPC Chair |
| RE | CMPT 776 New Course Proposal |
| | |
| DATE | November 20, 2024 |

**COURSE PROPOSAL CMPT 776 – Effective Fall 2025**

CMPT 776 – Quantum Algorithms

The School of Computing Science is proposing a new graduate course effective Fall 2025 – CMPT 776 Quantum Algorithms. This course will be cross-listed with CMPT 476. The course will be offered once every two years, alternating years with MATH 776.

Quantum algorithms use quantum mechanical phenomenon to solve certain problems faster than thought to be possible classically. This course offers an introduction to the field of quantum computing with an emphasis on the design and implementation of quantum algorithms. Topics include the fundamentals of quantum information and computation, along with seminal quantum algorithms.

If you have any questions, please let me know.

Dr. Manolis Savva

Graduate Chair, School of Computing Science

SFU GRADUATE STUDIES

# NEW GRADUATE COURSE PROPOSAL

| | | |
|---|---|---|
| **Course Subject (eg. PSYC)** CMPT | **Number (eg. 810)** 776 | **Units (eg. 4)** 3 |

**Course title** (max. 100 characters): Quantum Algorithms

**Short title** (for enrollment/transcript, max. 30 characters): Quantum Algorithms

**Course description for SFU Calendar** (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description. Max. 50 words)

Introduction to the field of quantum computing with an emphasis on the design and implementation of quantum algorithms. Topics include the fundamentals of quantum information, computation, and seminal algorithms. No prior knowledge of quantum physics is required, but a strong background in linear algebra (MATH 240 or equivalent) is recommended.

**Rationale for introduction of this course** (if more space is required, add a separate page)

This course is intended as a grad-level offering of the existing CMPT 476 - Introduction to Quantum Algorithms course, and will serve as an introduction to quantum computing for incoming graduate students who will be conducting research in the area. Offerings will be held together with CMPT 476, with additional instructor-dependent course requirements at the graduate level. Suggested graduate-specific requirements are additional, more challenging exercises which can be optionally completed at the undergraduate level for extra enrichment, along with an additional research project. The equivalent pair MATH 476/776 follows the same pattern and will be offered in alternating years with CMPT 476/776.

| | | | |
|---|---|---|---|
| **Term of initial offering** (eg. Fall 2019) | Fall 2025 | **Course delivery** (eg. 3 hrs/week for 13 weeks) | 3 hrs/week for 13 weeks |
| **Frequency of offerings/year** | Once every 2 years | **Estimated enrollment per offering** | 10 (60-75 combined with CMPT 476) |

## EQUIVALENT COURSES

Courses that replicates the content of this course to such an extent that students should not receive credit for both courses. Please select the one that is most relevant.

| ☐ **SEQUENTIAL COURSE** | ☐ **ONE-WAY EQUIVALENCY** | ☑ **TWO-WAY EQUIVALENCY** |
|---|---|---|
| [is not hard coded in the student information management system (SIMS).] Students who have taken (place relevant course(s) in the blank below (ex: STAT 603)) first may not then take this course for further credit. | [is not hard coded in SIMS.] (Place relevant course(s) in the blank below (ex: STAT 603)) will be accepted in lieu of this course. | [is hard coded and enforced by SIMS.] Students with credit for (place relevant course(s) in the blank below (ex: STAT 603)) may not take this course for further credit. |
| | | CMPT 476<br>MACM 476<br>MATH 776 |

Does the partner academic unit agree that this is a two-way equivalency? ☑ YES ☐ NO

*Please also have the partner academic unit submit a course change form to update the course equivalency for their course(s).*

**Prerequisite and/or Corequisite**

**Criminal record check required?** ☐ Yes (if yes is selected, add this as prerequisite)

**Additional course fees?** ☐ Yes ☑ No

**Campus where course will be taught** ☑ Burnaby ☐ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

**Course Components** * ☑ Lecture ☐ Seminar ☐ Lab ☐ Capstone ☐ Practicum ☐ Online ☐ Other: _____

**Grading Basis** ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

* See important definitions on the curriculum website.

| | | |
|---|---|---|
| **Repeat for credit?** ☐ Yes ☑ No | **Total completions allowed?** 1 | **Repeat within a term?** ☐ Yes ☑ No |
| **Required course?** ☐ Yes ☑ No | **Final exam required?** ☑ Yes ☐ No | |

**Combined with an undergraduate course?** ☑ Yes ☐ No If yes, identify which undergraduate course and the additional course requirements for graduate students. Please include a copy of the undergraduate course outline and fill out the Equivalent Courses section above.

CMPT 476. Additional requirements for graduate students are extra and more challenging assigned work (e.g. problem sets and/or projects).

## RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

**Faculty member(s) who will normally teach this course**

Matthew Amy

**Additional faculty members, space, and/or specialized equipment required in order to offer this course**

Andrei Bulatov and Steven Pearce can also teach this course.

## CONTACT PERSON

| Academic Unit / Program | Name (typically, Graduate Program Chair) | Email |
|---|---|---|
| Computing Science | Manolis Savva (GPC) | msavva@sfu.ca |

## ACADEMIC UNIT APPROVAL

☑ A course outline / syllabus is included

Non-departmentalized faculties need not sign

| | | |
|---|---|---|
| **Graduate Program Committee** Manolis Savva | **Signature** | **Date** Dec 17th, 2024 |
| **Department Chair** Oliver Schulte | **Signature** Oliver Schulte Digitally signed by Oliver Schulte Date: 2024.12.18 09:39:57 -08'00' | **Date** Dec 18, 2024 |

## FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

| | | |
|---|---|---|
| **Faculty Graduate Studies Committee** Parvaneh Saeedi | **Signature** P.Saeedi | **Date** Dec 18, 2024 |

A library review will be conducted. If additional funds are necessary, Graduate Studies will contact the academic unit prior to SGSC.

## SENATE GRADUATE STUDIES COMMITTEE APPROVAL

| | | |
|---|---|---|
| **Senate Graduate Studies Committee** Mary O'Brien | **Signature** | **Date** January 14, 2025 |

**ADMINISTRATIVE SECTION** (for Graduate Studies office only)

Library Check: _____
Course Attribute: _____
Course Attribute Value: _____
Instruction Mode: _____
Attendance Type: _____

If different from regular units:
Academic Progress Units: _____
Financial Aid Progress Units: _____

# Course outline – CMPT 776 – Quantum Algorithms

## CALENDAR DESCRIPTION:

Quantum algorithms use quantum mechanical phenomenon to solve certain problems faster than thought to be possible classically. This course offers an introduction to the field of quantum computing with an emphasis on the design and implementation of quantum algorithms. Topics include the fundamentals of quantum information and computation, along with seminal quantum algorithms. No prior knowledge of quantum physics is required.

## COURSE DETAILS:

Quantum computing is a computational paradigm which utilizes quantum mechanical effects at the physical level to process information. By using these quantum effects, we can solve certain problems faster than the best-known classical methods, such as factorizing integers, simulating quantum mechanical systems, and solving some linear systems. Since the advent of such algorithms in the 90's, researchers in computing science, mathematics, physics, chemistry, engineering, and other fields have been attempting to not only build quantum computers but also to understand their power.

This course offers an introductory treatment to the field of quantum information and computation with an emphasis on algorithms. We will examine how the above and other quantum algorithms work, as well as their implications on computational complexity and issues and techniques relating to their physical realization. By the end of this course, students should understand the basic model of quantum information and computation, key quantum protocols and algorithms, and leave with a broad knowledge of how such algorithms are implemented and what the primary challenges in doing so are, from their high-level mathematical expression down to the physical realization.

As quantum computing is still largely a theoretical topic, coursework will be primarily proof based. Some minor coding may be involved, but the primary purpose of the course is to understand how quantum algorithms work, rather than to program them.

## TOPICS:

- Quantum mechanics
- Quantum information
- Gate-model quantum computation
- Key quantum algorithms

- Quantum error correction and fault tolerance
- Physical realization of quantum computation
- Additional topics such as hybrid algorithms and NISQ (noisy, intermediate-scale quantum) computing, as per class interest

## GRADING:

- Final Exam -- 35%
- Midterm Exam -- 15%
- Assignments -- 40%
- Final project – 10%

## REQUIREMENTS:

As quantum computing is an interdisciplinary field involving computer science, mathematics, and physics, the only formal requirements are satisfactory performance in linear algebra, which the course will rely upon heavily. Experience with topics such as algorithms, complexity, abstract algebra, and quantum mechanics will all be assets, but are not required.

## REFERENCE TEXTBOOK:

Michael A. Nielsen, Isaac L. Chaung, Quantum Computation and Quantum Information
ISBN: 9781107002173

SPRING 2024 - CMPT 476 D100

# INTRODUCTION TO QUANTUM ALGORITHMS (3)

*Class Number: 7127* *Delivery Method: In Person*

**COURSE TIMES + LOCATION:**

Jan 8 – Apr 12, 2024: Mon, Wed, Fri, 10:30–11:20 a.m.
Burnaby

**EXAM TIMES + LOCATION:**

Apr 18, 2024
Thu, 12:00–3:00 p.m.
Burnaby

**INSTRUCTOR:**

Matthew Amy
meamy@sfu.ca

**PREREQUISITES:**

MATH 232 or MATH 240, with a minimum grade of C-.

## Description

**CALENDAR DESCRIPTION:**

An introductory treatment of quantum computing with an emphasis on quantum algorithms. Topics include the gate model of quantum computation focusing on the design and implementation of quantum algorithms. Basic knowledge of algorithms and complexity will be an asset, but not required. No prior knowledge of physics or quantum mechanics is necessary, only a solid background in linear algebra. Students who have taken CMPT 409 in Summer 2020 and 2021 under the title "Intro to Quantum Computing" may not take this course for further credit.

**COURSE DETAILS:**

Quantum computing is a computational paradigm which utilizes quantum mechanical effects at the physical level to process information. By using these quantum effects we can solve certain problems faster than the best known classical methods, such as factorizing integers, simulating quantum mechanical systems, and solving some linear systems. Since the advent of such algorithms in the 90's, researchers in computing science, mathematics, physics, chemistry, engineering, and other fields have been attempting to not only build quantum computers but also to understand their power.

This course offers an introductory treatment to the field of quantum information and computation with an emphasis on algorithms. We will examine how the above and other quantum algorithms work, as well as their implications on computational complexity and issues and techniques relating to their physical realization. By the end of this course, students should understand the basic model of quantum information and computation, key quantum protocols and algorithms, and leave with a broad knowledge of how such algorithms are implemented and what the primary challenges in doing so are, from their high-level mathematical expression down to the physical realization.

As quantum computing is still largely a theoretical topic, coursework will be primarily mathematical and proof-based. Some minor coding may be involved, but the primary purpose of the course is to *understand* how quantum algorithms work rather than to program them.

## Topics

- Quantum mechanics
- Quantum information
- Gate-model quantum computation

Key quantum algorithms

Quantum error correction and Fault Tolerance

Physical realization of quantum computation

Additional topics such as hybrid algorithms and NISQ (noisy, intermediate-scale quantum) computing, as per class interest

## Grading

| | |
|---|---|
| Final Exam | 35% |
| Midterm Exam | 15% |
| Assignments | 50% |

**NOTES:**

Details to be discussed in class.

**REQUIREMENTS:**

As quantum computing is an interdiscplinary field involving computer science, mathematics, and physics, the only formal requirements are satisfactory performance in linear algebra, which the course will rely upon heavily. Experience with topics such as algorithms, complexity, abstract algebra, and quantum mechanics will all be assets, but are not required. It is expected that students will encounter some topics with which they have very little familiarity.

## Materials

**RECOMMENDED READING:**

Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing*
ISBN: 978-0198570493

Michael A. Nielsen, Isaac L. Chaung, *Quantum Computation and Quantum Information*
ISBN: 9781107002173

**REQUIRED READING NOTES:**

Your personalized Course Material list, including digital and physical textbooks, are available through the SFU Bookstore website by simply entering your Computing ID at: shop.sfu.ca/course-materials/my-personalized-course-materials.

**REGISTRAR NOTES:**

**ACADEMIC INTEGRITY: YOUR WORK, YOUR SUCCESS**

SFU's Academic Integrity website http://www.sfu.ca/students/academicintegrity.html is filled with information on what is meant by academic dishonesty, where you can find resources to help with your studies and the consequences of cheating. Check out the site for more information and videos that help explain the issues in plain English.

Each student is responsible for his or her conduct as it affects the university community. Academic dishonesty, in whatever form, is ultimately destructive of the values of the university. Furthermore, it is unfair and discouraging to the majority of students who pursue their studies honestly. Scholarly integrity is required of all members of the university.
http://www.sfu.ca/policies/gazette/student/s10-01.html

**RELIGIOUS ACCOMMODATION**

Students with a faith background who may need accommodations during the term are encouraged to assess their needs as soon as possible and review the Multifaith religious accommodations website. The page outlines ways they begin working toward an accommodation and ensure solutions can be reached in a timely fashion.

SFU FACULTY OF ARTS AND SOCIAL SCIENCES | OFFICE OF THE DEAN

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# Memo

| | |
|---|---|
| **Attention** | Mary O'Brien, Vice-Provost and Dean, Graduate Studies |
| **From** | Kate. Slaney, Associate Dean, Graduate and Postdoctoral Studies, FASS |
| **Subject** | Items for SGSC meeting |
| **Date** | October 28, 2024 |

Dear Mary,

The following were approved by the Faculty of Arts and Social Sciences Graduate Studies Committee on October 8, 2024, and are forwarded to the Senate Graduate Studies Committee for approval. Please include them on the next SGSC agenda.

**1 Department of French**

New Course FREN891 Proposal
To be effective for Fall 2025

**2 Department of International Studies**

~~Calendar Change~~
~~Graduate Course IS800 Change~~
~~Graduate Course IS830 Change~~
New Course IS 804 Proposal
To be effective for Fall 2025.

~~**3 Department of Criminology**~~

~~Graduate Course CRIM870 Change~~
~~To be effective for Fall 2025~~

~~**4 Department of Psychology**~~

~~Calendar Change~~
~~Graduate Course PSYC990, PSYC897, PSYC892, PSYC890, PSYC836, PSYC815, Change to be effective for as soon as possible.~~

~~**5 Department of Philosophy**~~

~~Calendar Change~~
~~To be effective for Fall 2025~~

Please add these items for consideration at the next SGSC meeting. Thank you.

Sincerely,

Kathleen (Kate) Slaney
Associate Dean, Graduate and Postdoctoral Studies,
Faculty of Arts and Social Sciences
Simon Fraser University

Cover Memo to FASS GSC

To: Kate Slaney, Chair of the FASS Graduate Studies Committee
From: Gaelle Planchenault
Re: New Course FREN891 Directed Readings in French Literature and/or Linguistics
Date: 2024-09-11

The following new course has been approved by the Faculty of French during its latest Department meeting (August 21 2024) and is forwarded to the FASS Graduate Studies Committee for approval. This curriculum item should be effective for Fall 2025. Please include them on the next SGSC agenda.

***Department of French***

*New course: FREN891*

_____

Faculty Graduate Chair

SFU GRADUATE STUDIES

# NEW GRADUATE COURSE PROPOSAL

| | | |
|---|---|---|
| **Course Subject (eg. PSYC)** FREN | **Number (eg. 810)** 891 | **Units (eg. 4)** 3 |

**Course title** (max. 100 characters): Directed Readings in French Literature and/or Linguistics

**Short title** (for enrollment/transcript, max. 30 characters): French Directed Readings

**Course description for SFU Calendar** (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description. Max. 50 words)

Pursuance of particular areas of interest related to a student's program. Students may repeat this course for further credit under a different topic.

**Rationale for introduction of this course** (if more space is required, add a separate page)

This graduate-level seminar will allow students to pursue a specific topic in their area of study or research and with the guidance of their supervisor or of one Faculty member in the Department of French.

| | |
|---|---|
| **Term of initial offering** (eg. Fall 2019) Fall 2025 | **Course delivery** (eg. 3 hrs/week for 13 weeks) 3 |
| **Frequency of offerings/year** As requested | **Estimated enrollment per offering** One |

## EQUIVALENT COURSES

Courses that replicates the content of this course to such an extent that students should not receive credit for both courses. Please select the one that is most relevant.

| ☐ **SEQUENTIAL COURSE** | ☐ **ONE-WAY EQUIVALENCY** | ☐ **TWO-WAY EQUIVALENCY** |
|---|---|---|
| [is not hard coded in the student information management system (SIMS).] Students who have taken (place relevant course(s) in the blank below (ex: STAT 603)) first may not then take this course for further credit. | [is not hard coded in SIMS.] (Place relevant course(s) in the blank below (ex: STAT 603)) will be accepted in lieu of this course. | [is hard coded and enforced by SIMS.] Students with credit for (place relevant course(s) in the blank below (ex: STAT 603)) may not take this course for further credit. |
| | | |

Does the partner academic unit agree that this is a two-way equivalency? ☐ YES ☐ NO

*Please also have the partner academic unit submit a course change form to update the course equivalency for their course(s).*

**Prerequisite and/or Corequisite**

N/A

**Criminal record check required?** ☐ Yes (if yes is selected, add this as prerequisite) **Additional course fees?** ☐ Yes ☑ No

**Campus where course will be taught** ☑ Burnaby ☐ Surrey ☑ Vancouver ☐ Great Northern Way ☐ Off campus

**Course Components** * ☐ Lecture ☑ Seminar ☐ Lab ☐ Capstone ☐ Practicum ☐ Online ☐ Other: _____

**Grading Basis** ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

* See important definitions on the curriculum website.

| | | |
|---|---|---|
| **Repeat for credit?** ☑ Yes ☐ No | **Total completions allowed?** 3 (if different topic) | **Repeat within a term?** ☐ Yes ☑ No |
| **Required course?** ☐ Yes ☑ No | **Final exam required?** ☐ Yes ☑ No | |

**Combined with an undergraduate course?** ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students. Please include a copy of the undergraduate course outline and fill out the Equivalent Courses section above.

## RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

**Faculty member(s) who will normally teach this course**

All faculty members in the Department of French may teach this course

**Additional faculty members, space, and/or specialized equipment required in order to offer this course**

## CONTACT PERSON

| Academic Unit / Program | Name (typically, Graduate Program Chair) | Email |
|---|---|---|
| Gaelle Planchenault | Graduate Program Chair | gplanche@sfu.ca |

## ACADEMIC UNIT APPROVAL

☑ A course outline / syllabus is included

Non-departmentalized faculties need not sign

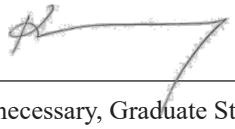
| | | | |
|---|---|---|---|
| **Graduate Program Committee** Gaelle Planchenault | **Signature** | Gaelle Planchenault Digitally signed by Gaelle Planchenault Date: 2024.09.20 16:06:04 -07'00' | **Date** 2024-09-20 |
| **Department Chair** Jorge Calderón | **Signature** | Jorge Calderon Digitally signed by Jorge Calderon Date: 2024.09.21 11:36:11 -07'00' | **Date** 2024-09-20 |

## FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

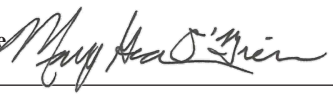
Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

| | | | |
|---|---|---|---|
| **Faculty Graduate Studies Committee** Kate Slaney | **Signature** |  | **Date** 2024-10-30 |

A library review will be conducted. If additional funds are necessary, Graduate Studies will contact the academic unit prior to SGSC.

## SENATE GRADUATE STUDIES COMMITTEE APPROVAL

| | | | |
|---|---|---|---|
| **Senate Graduate Studies Committee** Mary O'Brien | **Signature** |  | **Date** January 14, 2025 |

**ADMINISTRATIVE SECTION** (for Graduate Studies office only)

Library Check: _____
Course Attribute: _____
Course Attribute Value: _____
Instruction Mode: _____
Attendance Type: _____

If different from regular units:
Academic Progress Units: _____
Financial Aid Progress Units: _____

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

**SCHOOL FOR INTERNATIONAL STUDIES**
515 West Hastings Street, Suite 7200
Vancouver BC Canada V6B 5K3
T 778.782.9580 | F 778.782.7837 |

TO: Kate Slaney, FASS Associate Dean
FROM: Christopher Gibson, Graduate Program Chair, School for International Studies
CC: Elizabeth Cooper, Director, School for International Studies
DATE: September 23, 2024
RE: Changes to Masters in International Studies curriculum

Dear Dean Slaney,

As of September 9, 2024, the School for International Studies faculty have approved the following curricular changes to the Master in International Studies (MAIS) program to be effective in Fall 2025 or as early as possible. The changes consist of the following:
~~- First, IS806 (State Failure and Reconstruction: Comparative Perspectives) will change from being a required course to being an elective course.~~
~~- Second, IS801 (Polities, Institutions and Development) will also change from being a required to an elective course.~~
~~- Third, a new, required course named IS804 (Approaches to International Studies) will be added. It will cover key substantive and theoretical areas related to our three streams of coursework. The new course form that we previously submitted describes its content.~~
~~- Fourth, to maintain the total required credit count for the degree at its current level and accommodate the three changes above, we propose to change the program's calendar entry so that all students are required to take one more elective than is currently stated.~~
~~- Fifth, we are updating the course calendar description for IS 800 (Problems of International Policy and Practice) to describe a change in its format.~~
~~- Finally, IS830 (Analytic Approaches for International Studies) will be renamed IS830 (Methods for International Studies) to clarify its focus as a methods course, with minimal changes to the calendar description and content.~~

~~Accompanying this memo are the associate forms required for these proposals: a program change form, a course change form for IS 800, and a course change form for IS 830. Please note that we previously submitted a new course form for IS 804 in order to meet the earlier deadline for new course proposals.~~ We hope that these proposals will be considered together at the Fall 2024 FASS Graduate Curriculum Committee meeting. Thank you for your consideration.

Sincerely,

Christopher Gibson
Graduate Program Chair, School for International Studies

SFU GRADUATE STUDIES

# NEW GRADUATE COURSE PROPOSAL

| | | |
|---|---|---|
| **Course Subject** (eg. PSYC) IS | **Number** (eg. 810) 804 | **Units** (eg. 4) 4 |

**Course title** (max. 100 characters) Approaches to International Studies

**Short title** (for enrollment/transcript - max 30 characters) Approaches to International Studies

**Course description for SFU Calendar** *(course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description. Max. 50 words)

An overview of the history of international studies and delving into some of the key debates and approaches in the field. Topics include international security, the politics of development, debates over identity and migration.

**Rationale for introduction of this course**

Currently, there is no course that can provide an overview of International Studies for master's students, many of whom do not have a background in the discipline. They will be provided with the opportunity to grapple with some of the key theories and concepts used in this multidisciplinary field.

| | |
|---|---|
| **Term of initial offering** (eg. Fall 2019) Fall 2025 | **Course delivery** (eg 3 hrs/week for 13 weeks) 3hrs/week for 13 weeks |
| **Frequency of offerings/year** 1/year | **Estimated enrollment per offering** 12-18 |

**Equivalent courses** (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

**Prerequisite and/or Corequisite**

None.

**Criminal record check required?** ☐ Yes (if yes is selected, add this as prerequisite) **Additional course fees?** ☐ Yes ☑ No

**Campus where course will be taught** ☐ Burnaby ☐ Surrey ☑ Vancouver ☐ Great Northern Way ☐ Off campus

**Course Components*** ☐ Lecture ☑ Seminar ☐ Lab ☐ Research ☐ Practicum ☐ Online ☐ Other: _____

**Grading Basis** ☑ Letter grades ☐ Satisfactory or Unsatisfactory ☐ In Progress/Complete

| | | |
|---|---|---|
| **Repeat for credit?** ☐ Yes ☑ No | **Total repeats allowed?** _____ | **Capstone course?** ☐ Yes ☑ No |
| **Required course?** ☑ Yes ☐ No | **Final exam required?** ☐ Yes ☑ No | **Repeat within a term?** ☐ Yes ☑ No |

**Combined with an undergrad course?** ☐ Yes ☑ No If yes, identify which undergraduate course and what the additional course requirements are for graduate students:

* See important definitions on the curriculum website.

## RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

| |
|---|
| **Faculty member(s) who will normally teach this course**<br>Jason Stearns, Liz Cooper, Nazanin Shahrokni, Tamir Moustafa |
| **Additional faculty members, space, and/or specialized equipment required in order to offer this course**<br>None. |

## CONTACT PERSON

| | | |
|---|---|---|
| **Academic Unit / Program**<br>International Studies | **Name (typically, Graduate Program Chair)**<br>Christopher L. Gibson | **Email** clgibson@sfu.ca |

## ACADEMIC UNIT APPROVAL

☑ A course outline / syllabus is included

Non-departmentalized faculties need not sign

| | | |
|---|---|---|
| **Department Graduate Program Committee**<br>Christopher L. Gibson | **Signature** | **Date** September 10, 2024 |
| **Department Chair**<br>Elizabeth Cooper | **Signature** | **Date** September 10, 2024 |

## FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

overlap check done? ☐ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

| | | |
|---|---|---|
| **Faculty Graduate Studies Committee (FGSC)**<br>Kate Slaney | **Signature** | **Date** 2024-10-30 |

A library review will be conducted. If additional funds are necessary, Graduate Studies will contact the academic unit prior to SGSC.

## SENATE GRADUATE STUDIES COMMITTEE APPROVAL

| | | |
|---|---|---|
| **Senate Graduate Studies Committee (SGSC)**<br>Mary O'Brien | **Signature** | **Date** January 14, 2025 |

**ADMINISTRATIVE SECTION (for Graduate Studies office only)**

Course Attribute: _____
Course Attribute Value: _____
Instruction Mode: _____
Attendance Type: _____

If different from regular units:
Academic Progress Units: _____
Financial Aid Progress Units: _____

**IS804-4 Approaches to International Studies**

**Instructor:** Jason Stearns

**Course description:** This course offers an introduction to international studies. During the first part of the course, students will be given an overview of the history and definition of international studies. They will also be provided with the opportunity to grapple with some of the key theories and concepts used in this multidisciplinary field.

The second part of the course delves into some of the key debates and approaches in the field:

- International Security, Conflict, Peace, and Governance
- States, People, and Power
- International Development, Inequality, Environment, and Shared Futures

Students will read core texts in these areas and apply their arguments to contemporary challenges. This class is part of the core sequence of classes for the Masters in International Studies that prepares students for their extended essays or final thesis. Students will be given the opportunity to explore topics they are interested in for their assignments.

**Grading:** The final grade for the course will be based on the following requirements:

| | |
|---|---|
| Literature analysis | 30% |
| Response papers | 25% |
| Final paper | 30% |
| Participation | 15% |

To receive credit for the course, you must complete all of the above written requirements.

**Required readings:**

WEEK 1: KEY CHALLENGES IN THE REALM OF INTERNATIONAL POLITICS

Hamlin, Rebecca. (2021). *Crossing*. Stanford University Press. Ch 1

Joshua Busby (2019) “A Warming World.” Foreign Affairs

Ron Deibert (2019) “The Road to Digital Unfreedom” Journal of Democracy

WEEK 2: THEORETICAL APPROACHES TO INTERNATIONAL STUDIES

Jack Snyder (2004). "One World, Rival Theories," Foreign Policy.

Susan Mannon (2017). *City of flowers: An ethnography of social and economic change in Costa Rica’s Central valley*. New York: Oxford University Press, Chapter 1&2.

D. Stanley Eitzen and Maxine Baca Zinn (2012). *Globalization: The Transformation of Social Worlds*. Chapter 1.

WEEK 3: INTERNATIONAL SECURITY: THEORIES OF WAR

Robert Jervis, "Theories of War in an Era of Great Power Peace: Presidential Address, American Political Science Association 2001," American Political Science Review Volume 96, Issue 1 (March 2002) (available online)

Tarak Barkawi, “Decolonising War,” European Journal of International Security, 1 (2). pp. 199-214.

Errol Henderson, "Hidden in plain sight: racism in international relations theory," *Race and Racism in International Relations*. Routledge, 2014. 19-43.

Laura Sjoberg (2009). Introduction to Security Studies: Feminist Contributions. Security Studies. 18(2), 183–213.

WEEK 4: INTERNATIONAL SECURITY: INSTITUTIONS

John J. Mearsheimer (1994) The False Promise of International Institutions. International Security. 19(3)Winter, 5–49

Michael Doyle (1997). *Ways of War and Peace*. New York: Norton. p.205-212, 251-300, 474-84, 495-502.

Andrew Mack, “Global Political Violence: Explaining the Post-Cold War Decline,” Coping With Crisis Working Paper Series International Peace Academy (March 2007)

WEEK 5: INTERNATIONAL SECURITY: CASE STUDY

Jason Stearns (2023). “Mboka esi Ekufa: The Violent Order of the Congolese State.”

Stylianos Moshonas (2023). “The political economy of human resource and payroll management in the Democratic Republic of the Congo,” Secure Livelihood Research Consortium, 2019.

WEEK 6: INTERNATIONAL POLITICAL ECONOMY: INTRODUCTION

Albert Einstein. 1949. “What is Socialism.” *Monthly Review*. 1(1):

Patricia Cohen. 2023. “Failures of Globalization Shatter Long-Held Beliefs.” *New York Times*. June 18, 2023.

Davide Gualerzi. 2012. “Development Economics: A Theoretical and Historical Perspective.” *International Journal of Political Economy.* 41(3):3-23.

Arturo Escobar. 1991. “Anthropology and the Development Encounter: The Making and Marketing of Development Anthropology.” *American Ethnologist*. 18(4):658-682.

WEEK 7: INTERNATIONAL POLITICAL ECONOMY: THE WORLD BANK AND DEVELOPMENT

Albert O. Hirschman. 1965. "Obstacles to Development: A Classification and a Quasi-Vanishing Act." *Economic Development and Cultural Change.* 13(4):385-393.

João Márcio Mendes Pereira. 2020. "The World Bank's 'Assault on Poverty' as a Political Question." Development and Change 0(0): 1–28. DOI: 10.1111/dech.12615.

Rodwan Abouharb and Erick Duchesne. 2019. "Economic Development and the World Bank." *Social Sciences*. 8:156. doi:10.3390/socsci8050156.

Jorge Buzaglo and Leo Buzaglo Olofsgård. 2022. "Keynes', Piketty's and an Extensive Failure Index: Introducing Maldevelopment Indices." *Real-World Economics Review*. Issue No. 99.

Jeremy Adelman. 2015. "Hirschman, Albert O. (1915-2012)." International Encyclopedia of the Social & Behavioral Sciences, 2nd edition, Volume 10. http://dx.doi.org/10.1016/B978-0-08-097086-8.61214-X.

Michele Alacevich. 2014. "Visualizing Uncertainties, or How Albert Hirschman and the World Bank Disagreed on Project Appraisal and What this Says about the End of 'High Development Theory'." *Journal of the History of Economic Thought*. 36(2):137-168.

WEEK 8: INTERNATIONAL POLITICAL ECONOMY: CLIMATE CHANGE AND THE ECONOMY

Timothy Mitchell (2015). *Carbon Democracy* (selections).

WEEK 9: STATES, PEOPLE, AND POWER

Aronoff, Myron J. and Jan Kubik, "What Political Scientists Learn about Civil Society from Anthropologists about Civil Society?", Anthropology & Political Science: A Convergent Approach (New York: Berghan Books, 2013), pp. 198-239.

Steinmetz, G. (Ed.). (1999). *State/culture: State-formation after the cultural turn*. Cornell University Press.

Evans, P. B. (1985). *Bringing the state back in*. Cambridge University Press.

Morgan, K. J., & Orloff, A. S. (Eds.). (2017). *The many hands of the state: Theorizing political authority and social control*. Cambridge University Press.

Wallenstein, S. O., & Nilsson, J. (2013). *Foucault, biopolitics, and governmentality*. Södertörns högskola.

Macey, D. (2009). Rethinking Biopolitics, Race and Power in the Wake of Foucault. *Theory, Culture & Society*, 26(6), 186-205.

WEEK 10: STATES, PEOPLE, AND POWER

Andrews, A. L. (2018). *Undocumented politics: Place, gender, and the pathways of Mexican migrants*. Univ of California Press.

Parreñas, R. (2015). *Servants of globalization: Migration and domestic work*. Stanford University Press.

Pallister-Wilkins, P. (2022). *Humanitarian borders: Unequal mobility and saving lives*. Verso Books.

WEEK 11: STATES, PEOPLE, AND POWER

Brown, Wendy (2010) *Walled States, Waning Sovereignty*. New York: Zone Books.

Fassin, D., & Pandolfi, M. (2010). *Contemporary states of emergency. The politics of military and humanitarian interventions*. Zone Books.

Rodríguez, E., & Chaves, M. E. (2000). *Hidden histories of gender and the state in Latin America*. Duke University Press.

WEEK 12: CONCLUSION

Byler, D. (2021). *Terror capitalism: Uyghur dispossession and masculinity in a Chinese city*. Duke University Press.

Cooper, E. (2022). *Burning Ambition: education, arson, and learning justice in Kenya*. University of Wisconsin Pres.

Moustafa, T. (2007). *The struggle for constitutional power: law, politics, and economic development in Egypt*. Cambridge University Press.

Shahrokni, N. (2020). *The Politics of Gender Segregation in Iran*. University of California Press.

SFU

**MEMO**

**Faculty of Science**

ATTENTION: Senate Graduate Studies Committee

FROM: Vance Williams, Associate Dean Graduate Studies, Faculty of Science

RE: Proposed Course Additions Fall 2025, Faculty of Science

DATE: December 4, 2024

Dear SGSC,

The following curriculum changes have been approved by the Faculty of Science and are being submitted to the Senate Graduate Studies committee for approval.

The following *new course* is being proposed:

**MATH 776** Quantum Computation

Enclosed are the documents in support of these changes.

Sincerely,

Vance Williams
Associate Dean Graduate Studies, Faculty of Science

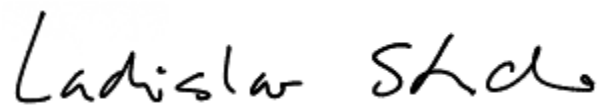
To:  Dr. Vance Williams, Associate Dean, Graduate Studies, Faculty of Science, SFU
From: Ladislav Stacho, Graduate Program Chair, Mathematics

Re: New course MATH 776
Date: 29 September 2024

The following proposal of the new course has been discussed at the Faculty of Science meeting on September 19, 2024. A question about title change has been addressed.

***Department of Mathematics***

*New course: MATH 776*



_____
Ladislav Stacho, Graduate Program Chair, Mathematics

SFU GRADUATE STUDIES

# NEW GRADUATE COURSE PROPOSAL

| | | |
|---|---|---|
| **Course Subject** (eg. PSYC) MATH | **Number** (eg. 810) 776 | **Units** (eg. 4) 3 |

**Course title** (max. 100 characters) Quantum Computation

**Short title** (for enrollment/transcript - max 30 characters) Quantum Computation

**Course description for SFU Calendar** *(course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description. Max. 50 words)

Foundations of mathematical techniques in quantum computing with an emphasis on quantum algorithms. We will examine communication protocols (e.g. quantum teleportation), quantum algorithms (e.g. Shor's factoring algorithm), their computational advantages, and techniques relating to their physical realisation. Knowledge of basic theoretical computer science is an asset but not required.

**Rationale for introduction of this course**

This course is being introduced in support of the Quantum Computing initiative at SFU. The MATH and CMPT departments have agreed to support an annual 4th-year undergrad course presenting fundamental ideas on quantum algorithms by each offering it in alternating years.

| | |
|---|---|
| **Term of initial offering** (eg. Fall 2019) Fall 2025 | **Course delivery** (eg 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks |
| **Frequency of offerings/year** Once every 2 years | **Estimated enrollment per offering** 5-10 |

**Equivalent courses** (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

CMPT 476, MACM 476, CMPT 776, CMPT 981 under the title "Introduction to Quantum Algorithms".

**Prerequisite and/or Corequisite**

None

**Criminal record check required?** ☐ Yes (if yes is selected, add this as prerequisite) | **Additional course fees?** ☐ Yes ☑ No

**Campus where course will be taught** ☑ Burnaby ☐ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

**Course Components*** ☑ Lecture ☐ Seminar ☐ Lab ☐ Research ☐ Practicum ☐ Online ☐ Other: _____

**Grading Basis** ☑ Letter grades ☐ Satisfactory or Unsatisfactory ☐ In Progress/Complete

| | | |
|---|---|---|
| **Repeat for credit?** ☐ Yes ☑ No | **Total repeats allowed?** _____ | **Capstone course?** ☐ Yes ☑ No |
| **Required course?** ☐ Yes ☑ No | **Final exam required?** ☑ Yes ☐ No | **Repeat within a term?** ☐ Yes ☑ No |

**Combined with an undergrad course?** ☑ Yes ☐ No If yes, identify which undergraduate course and what the additional course requirements are for graduate students:

MACM 476, additional assigments/challenge problems on problems sets and exams for grad students that involve more sophisticated maths and problem-solving abilities, possible research term paper with oral presentation for grad students.

* See important definitions on the curriculum website.

## RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

| |
|---|
| **Faculty member(s) who will normally teach this course**<br>Nadish de Silva |
| **Additional faculty members, space, and/or specialized equipment required in order to offer this course**<br>Imin Chen, Petr Lisonek, Jonathan Jedwab |

## CONTACT PERSON

| | | |
|---|---|---|
| **Academic Unit / Program**<br>Mathematics | **Name (typically, Graduate Program Chair)**<br>Ladislav Stacho | **Email** ladislav_stacho@sfu.ca |

## ACADEMIC UNIT APPROVAL

☑ A course outline / syllabus is included

Non-departmentalized faculties need not sign

| | | |
|---|---|---|
| **Department Graduate Program Committee**<br>Ladislav Stacho | **Signature** Ladislav Stacho Digitally signed by Ladislav Stacho Date: 2024.09.26 20:26:09 -07'00' | **Date** Sep. 26, 2024 |
| **Department Chair**<br>Cedric Chauve | **Signature** cedric chauve Digitally signed by cedric chauve Date: 2024.09.27 09:40:18 -07'00' | **Date** 2024-09-27 |

## FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

| | | |
|---|---|---|
| **Faculty Graduate Studies Committee (FGSC)**<br>Vance Williams | **Signature** Vance Williams Digitally signed by Vance Williams Date: 2024.12.10 09:27:50 -08'00' | **Date** December 10, 2024 |

A library review will be conducted. If additional funds are necessary, Graduate Studies will contact the academic unit prior to SGSC.

## SENATE GRADUATE STUDIES COMMITTEE APPROVAL

| | | |
|---|---|---|
| **Senate Graduate Studies Committee (SGSC)**<br>Mary O'Brien | **Signature** Mary Ann O'Brien | **Date** January 14, 2025 |

**ADMINISTRATIVE SECTION (for Graduate Studies office only)**

Course Attribute: _____
Course Attribute Value: _____
Instruction Mode: _____
Attendance Type: _____

If different from regular units:
Academic Progress Units: _____
Financial Aid Progress Units: _____

# Course Outline

## MATH 776 - Quantum Computation

This course will cover the flagship results of quantum computing and algorithms from a mathematical perspective. We will assume no prior knowledge of these topics, only a fluency with linear algebra. We will provide background material on quantum mechanics, quantum circuits, and communication protocols such as the famous quantum teleportation protocol. We will then follow the development of early quantum algorithms, culminating in a presentation of Shor's polynomial-time integer factorisation algorithm.

Students will learn the material primarily by working through problem sets and preparing for exams that will challenge them to technically prove statements about quantum computing. Graduate students will be given extra assignments, as well as extra challenge problems on problem sets and exams that will require more sophisticated mathematical knowledge and problem-solving skills. Depending on enrolment numbers, they may also be required to write a research term paper and give an oral presentation.

**Grading scheme**

- 30% assignments
- 15% midterm exam
- 35% final exam
- 20% final project

If enrollment numbers are too high for individual final projects to be feasible, the assignments portion will be worth 50%. In this case, the assignments will contain extra challenge problems which may be evaluated via oral presentation.

**Textbooks**

We will recommend Nielsen & Chuang (*Quantum Information and Computation)* but it will not be strictly required. There are many free and publicly available notes covering this material, e.g. Richard Josza's lecture notes (https://www.qi.damtp.cam.ac.uk/files/PartIIIQC/Part%202%20QIC%20lecturenotes.pdf).

**Lecture schedule**

We will closely follow the schedule used for earlier iterations of this course, e.g.:

The circuit model of computation
Qubits & basic measurement
Operators and state evolution
Operators cont.
Fun and games with a single qubit
Composite systems
Partial measurements and spooky action at a distance
Non-local games and Bell's inequality
Projective measurements
Mixed states and density matrices
Reduced density matrices and No Communication
Superdense coding and Bell basis measurements
Quantum teleportation and the No-Cloning theorem
Quantum computation and complexity theory
Gate sets and quantum universality
Gate sets and quantum universality cont.
Reversible computation
Midterm review
Introduction to quantum algorithms
Early black-box algorithms
Simon's algorithm
Simon's algorithm cont.
Integer factorization
The Quantum Fourier Transform
Shor's period finding algorithm
Shor's period finding algorithm cont.
Discrete logarithms and the Hidden Subgroup Problem (HSP)
Eigenvalue estimation
Hamiltonians and the Ground State Energy problem
Digital Hamiltonian simulation
Grover's search algorithm
Applications of Grover's algorithm
Error correction
Quantum error correcting codes
Fault tolerance

## MACM 476

# INTRODUCTION TO QUANTUM ALGORITHMS (3)

## Overview

- ***PREREQUISITES:***
  MATH 232 or MATH 240, with a minimum grade of C-.

## Description

***CALENDAR DESCRIPTION:***

An introductory treatment of quantum computing with an emphasis on quantum algorithms. Topics include the gate model of quantum computation focusing on the design and implementation of quantum algorithms. Basic knowledge of algorithms and complexity will be an asset, but not required. No prior knowledge of physics or quantum mechanics is necessary, only a solid background in linear algebra. Students with credit for CMPT 476 may not take this course for further credit. Students who have taken CMPT 409 in Summer 2020 and 2021 under the title "Intro to Quantum Computing" may not take this course for further credit.

***COURSE DETAILS:***

This course is equivalent to CMPT 476 and satisfies the same sets of course requirements.  Interested students from Computer Science and Physics are encouraged to enroll.

Quantum computing is a computational paradigm which utilizes quantum mechanical effects at the physical level to process information. By using these quantum effects we can solve certain problems faster than the best known classical methods, such as factorizing integers, simulating quantum mechanical systems, and solving some linear systems. Since the advent of such algorithms in the 90's, researchers in computing science, mathematics, physics, chemistry, engineering, and other fields have been attempting to not only build quantum computers but also to understand their power.

This course offers an introductory treatment to the field of quantum information and computation with an emphasis on algorithms. We will examine how the above and other quantum algorithms work, as well as their implications on computational complexity and issues and techniques relating to their physical realization. By the end of this course, students should understand the basic model of quantum information and computation, key

quantum protocols and algorithms, and leave with a broad knowledge of how such algorithms are implemented and what the primary challenges in doing so are, from their high-level mathematical expression down to the physical realization.

As quantum computing is still largely a theoretical topic, coursework will be primarily mathematical and proof-based. Some minor coding may be involved, but the primary purpose of the course is to *understand* how quantum algorithms work rather than to program them.

#### COURSE-LEVEL EDUCATIONAL GOALS:

**Topics**

- Quantum mechanics
- Quantum information
- Gate-model quantum computation
- Key quantum algorithms
- Quantum error correction and fault-tolerance
- Physical realization of quantum computation
- Additional topics such from quantum information and foundations (e.g. contextuality/nonlocality, MBQC), as per class interest

# Grading

- Final Exam 35%
- Midterm Exam 15%

- Assignments 50%

#### REQUIREMENTS:

As quantum computing is an interdiscplinary field involving computer science, mathematics, and physics, the only formal requirements are satisfactory performance in linear algebra, which the course will rely upon heavily. Experience with topics such as algorithms, complexity, abstract algebra, and quantum mechanics will all be assets, but are not required. It is expected that students will encounter some topics with which they have very little familiarity.

# Materials

#### RECOMMENDED READING:

Michael A. Nielsen, Isaac L. Chaung, *Quantum Computation and Quantum Information*

ISBN: 9781107002173