S.19-107

SFU OFFICE OF THE ASSOCIATE VICE-PRESIDENT, ACADEMIC

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MEMORANDUM

ATTENTION	Senate	DATE	October 8, 2019
FROM	Wade Parkhouse, Chair Senate Committee on Undergraduate Studies	PAGES	1/1
RE:	New Course Proposals (SCUS 19-54)		

For information:

Acting under delegated authority at its meeting of October 3, 2019 SCUS approved the following curriculum revisions effective Summer 2020.

a. Faculty of Science (SCUS 19-54)

1. Department of Physics

(i) New Course Proposal: PHYS 416-3, Introduction to Quantum Information Science

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.

SCUS 19-54

SFU SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL
1 OF 4 PAGES

COURSE SUBJECT PHYS **NUMBER** 416

COURSE TITLE LONG — for Calendar/schedule, no more than 100 characters including spaces and punctuation

Introduction to Quantum Information Science

COURSE TITLE SHORT — for enrollment/transcript, no more than 30 characters including spaces and punctuation

Intro. Quantum Information

CAMPUS where course will be normally taught: ☑ Burnaby ☐ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

COURSE DESCRIPTION — 50 words max. Attach a course outline. Don't include WQB or prerequisites info in this description box.

Includes topics such as qubits, density matrices, mixed states, entanglement, basic quantum algorithms, quantum cryptography, computational models and complexity, introductory quantum error correction, and applications.

REPEAT FOR CREDIT ☐ YES ☑ NO Total completions allowed ☐ Within a term? ☐ YES ☐ NO

LIBRARY RESOURCES

NOTE: Senate has approved (S.93-11) that no new course should be approved by Senate until funding has been committed for necessary library materials. Each new course proposal must be accompanied by the email that serves as proof of assessment. For more information, please visit www.lib.sfu.ca/about/overview/collections/course-assessments.

RATIONALE FOR INTRODUCTION OF THIS COURSE

Quantum Computation and Quantum Information are important and rapidly growing areas of Physics. Additionally, SFU hosts a world leading group in this research area. Hence we intend to take advantage of this expertise to introduce a course to train students in what is likely to be an important area of Physics in the 21st Century.

SCHEDULING AND ENROLLMENT INFORMATION

Effective term and year (e.g. FALL 2016): Summer 2020

Term in which course will typically be offered: ☑ Spring ☐ Summer ☐ Fall

Other *(describe)*:

Will this be a required or elective course in the curriculum? ☐ Required ☑ Elective

What is the probable enrollment when offered? Estimate: 10

UNITS

Indicate number of units: 3

Indicate no. of contact hours: 3 Lecture | Seminar | 1 Tutorial | Lab | Other; explain below

OTHER

This course will be cross-listed with PHYS 816.

FACULTY

Which of your present CFL faculty have the expertise to offer this course?

Stephanie Simmons,Paul Haljan, Igor Herbut, Malcolm Kennett

WQB DESIGNATION

(attach approval from Curriculum Office)

Quantitative (pending)

PREREQUISITE AND / OR COREQUISITE

Prerequisite: PHYS 385; PHYS 384 or both MATH 314 and MATH 419, or equivalent. All prerequisite courses require a minimum grade of C-.

EQUIVALENT COURSES [For more information on equivalency, see Equivalency Statements under Information about Specific Course components.]

1. SEQUENTIAL COURSE [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 100)*) **first** may not then take this course for further credit.

2. ONE-WAY EQUIVALENCY [is not hard coded in SIMS.]

(*Place relevant course(s) in the blank below (ex: STAT 100)*) will be accepted in lieu of this course.

3. TWO-WAY EQUIVALENCY [is hard coded and enforced by SIMS.]

Students with credit for (*place relevant course(s) in the blank below (ex: STAT 100)*) 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).

4. SPECIAL TOPICS PRECLUSION STATEMENT [is not hard coded in SIMS.]

FEES

Are there any proposed student fees associated with this course other than tuition fees? ☐ YES ☑ NO

COURSE – LEVEL EDUCATIONAL GOALS (OPTIONAL)

-Calculate properties of quantum states (purity, fidelity, Bloch sphere coordinates, entanglement) when expressed as density matrices
-Calculate the outcomes of small-scale quantum algorithms expressed in quantum circuit notation
-Produce appropriate measurement projectors corresponding to quantum observables
-Build small-scale quantum algorithms capable of generating a target quantum state
-Determine which errors a quantum error-correcting algorithm will be robust against
-Construct basic quantum teleportation and error-correcting codes given certain operator constraints
-Design and implement algorithms able to perform quantum state tomography upon small-scale quantum systems

RESOURCES

List any outstanding resource issues to be addressed prior to implementation: space, laboratory equipment, etc:

OTHER IMPLICATIONS

Final exam required ☑ YES ☐ NO

Criminal Record Check required ☐ YES ☑ NO

OVERLAP CHECK

Checking for overlap is the responsiblity of the Associate Dean.

Each new course proposal must have confirmation of an overlap check completed prior to submission to the Faculty Curriculum Committee.

Name of Originator

Malcolm Kennett (physgchr@sfu.ca)