SFU OFFICE OF THE ASSOCIATE VICE-PRESIDENT, ACADEMIC

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MEMORANDUM

ATTENTION	Senate	**DATE**	February 6, 2015
FROM	Gordon Myers, Chair	**PAGES**	1/1
	Senate Committee on		
	Undergraduate Studies		
RE:	Faculty of Science		

For information:

Acting under delegated authority at its meeting of February 5, 2015 SCUS approved the following curriculum revisions effective Fall 2015.

1. <u>Department of Biomedical Physiology and Kinesiology (Revised SCUS 14-53c)</u>
   (i) New Course Proposal: BPK 443-3, Advanced Exercise Prescription
   (ii) Delete BPK 344

2. <u>Department of Chemistry (Revised SCUS 14-53d)</u>
   (i) New Course Proposal: CHEM 433-3, Bioinorganic Chemistry
   (ii) New Course Proposal: SCI 191-1, Introduction to Modern Scientific Research

3. <u>Department of Statistics (Revised SCUS 15-04a)</u>

   (i) Prerequisite change to STAT 475 (EFFECTIVE SUMMER 2015)

4. <u>Department of Math (SCUS 15-04b)</u>

   (i) New Course Proposals:
   - MATH 498-1, Communication and Research Skills in the Mathematical Sciences
   - MATH 499W-5, Honours Research Project
     - W Designation for MATH 499
   (ii) Changes to course number, description and prerequisite for MATH 370W
   (iii) Prerequisite change to MACM 201
   (iv) Changes to the Upper and Lower Division requirements for the Mathematics Honours Program

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(v) Changes to the Upper and Lower Division requirements for the Applied Mathematics Honours Program

(vi) Changes to the Lower Division requirements for the Applied Mathematics Major Program

5. <u>Department of Biological Sciences (SCUS 15-04c)</u>

(i) Requirement changes to the Biological Sciences Minor program

6. <u>Department of Physics (SCUS 15-04d)</u>

(i) Prerequisite change for PHYS 140, 141, 211, 321
(ii) Change to title, description and prerequisite for PHYS 231 *(EFFECTIVE SUMMER 2016)*
(iii) Change to title and prerequisite for PHYS 233 *(EFFECTIVE SUMMER 2016)*
(iv) New Course Proposals:
- PHYS 132-1, Physics Laboratory I
  - o Q Designation
- PHYS 133-1, Physics Laboratory II *(EFFECTIVE SPRING 2016)*
  - o Q Designation for:
(v) Lower Division Requirement changes to the:
- Applied Physics Program
- Applied Physics Honours Program
- Biological Physics Program
- Biological Physics Honours Program
- Chemical Physics Program
- Chemical Physics Honours Program
- Mathematical Physics Honours Program
- Physics Program
- Physics Honours Program

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MEMORANDUM ————————————————————————

ATTENTION	Senate Committee for Undergraduate Studies, SFU	**DATE**	December 19, 2014
FROM	Claire Cupples, Dean, Faculty of Science		
RE:	Resubmission of Undergraduate Curriculum Business from the Faculty of Science for inclusion on the Agenda of the January 2015 SCUS Meeting		

BPK

- Motion: BPK 443, approve new course proposal – resubmission (updated learning objectives and library approval

- Motion: BPK 344, approve deletion of course – this was originally tabled because it went along with MBB 443

Chemistry

- Motion: CHEM 433, approve new course proposal – resubmission (library approval)

-

- Motion: SCI 191, approve new course proposal – resubmission (updated interim grading comment and library approval)

Statistics

- Motion: STAT 341, approve credit change - Tabled

- Motion: STAT 342, approve credit change - Tabled

SFU **FACULTY OF SCIENCE**
Dean of Science

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MEMORANDUM ─────────────────────────────────

ATTENTION	Senate Committee for Undergraduate Studies, SFU	**DATE**	January 23, 2015
FROM	Carl Lowenberger, Chair, Science UCC		
RE:	Submission of Undergraduate Curriculum Business from the Faculty of Science for inclusion on the Agenda of the February 2015 SCUS Meeting		

STATS

- Motion: STAT 341, approve credit change – resubmission (updated rationale regarding final exam. Note: 2 unit course – 2 hour final exam

- Motion: STAT 342, approve credit change – resubmission (updated rationale regarding final exam. Note: 2 unit course – 2 hour final exam

MATH

- Motion: MATH 498-1, approve new course proposal (pass/fail grade)
- Motion: MATH 499-5, approve new course proposal
- Motion: MATH 370W, approve course number, description, and prerequisite change
- Motion: MACM 201, approve prerequisite change
- Motion: MATH Honours program calendar language changes - to change the LD and UD requirements.
- Motion: MATH Applied Math Honours program calendar language changes – to change LD and UD requirements
- Motion: MATH Applied Math Major program calendar language changes – to change LD and requirements

BIOLOGY

- Motion: Update BISC minor requirement in Calendar

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PHYSICS

- Motion: PHYS 140, approve prerequisite change
- Motion: PHYS 141, approve prerequisite change
- Motion: PHYS 211, approve prerequisite change
- Motion: PHYS 321, approve prerequisite change
- Motion: PHYS 231, approve title, description, and prerequisite change
- Motion: PHYS 233, approval title and prerequisite change
- Motion: PHYS 132, approval of new course proposal
- Motion: PHYS 133, approval of new course proposal
- Motion: Applied Physics Program calendar language, remove PHYS 131 and add PHYS 132 and 133

COURSE SUBJECT/NUMBER BPK 443

REVISED SCUS 14-53c

COURSE TITLE

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

Advanced Exercise Prescription

AND

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

Advanced Exercise Prescription

CAMPUS where course will be taught: [✓] Burnaby [ ] Surrey [ ] Vancouver [ ] Great Northern Way [ ] Off campus

COURSE DESCRIPTION (FOR CALENDAR). 50-60 WORDS MAXIMUM. ATTACH A COURSE OUTLINE TO THIS PROPOSAL.

This course covers evidence-based practice and quantitative modeling skills for prescribing effective exercise programs to any individual who has a specific health, rehabilitation or performance goal. Programming considerations for various special populations (e.g., those with chronic disease, elite athletes) will be emphasized through laboratory-based case studies representing diverse professional settings such as active rehabilitation, strength & conditioning and clinical exercise physiology.

REPEAT FOR CREDIT (●) NO ( ) YES   How many times? _____   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 a library report and, if appropriate, confirmation that funding arrangements have been addressed.

Library report status

RATIONALE FOR INTRODUCTION OF THIS COURSE

This course is being introduced to replace BPK 344 Exercise Prescription. Changes in description, title and prerequisites reflect the modifications required after the course was first taught by a new faculty member in this area. The course now uses primary research articles and has additional third year prerequisite (304W, 310) in scientific inquiry which warrant the course being offered at the fourth year level.

SCHEDULING AND ENROLLMENT INFORMATION

Indicate effective **term and year** course would first be offered and planned **frequency** of offering thereafter:

Fall 2015

Will this be a required or elective course in the curriculum? ( ) Required (●) Elective

What is the probable enrollment when offered?   Estimate: 30

CREDITS

Indicate number of credits (units):   3

Indicate number of hours for:

Lecture	Seminar	Tutorial	Lab	Other
2			2	

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

Dr David Clarke

WQB DESIGNATION (attach approval from Curriculum Office)

PREREQUISITE

Does this course replicate the content of a previously-approved course to such an extent that students should not receive credit for both courses? If so, this should be **noted in the prerequisite.**

Students with credit for BPK 344 or BPK 423-Advanced Exercise Prescription may not take this course for further credit. Prerequisite: BPK (or KIN) 304W, 310 and 343.

COREQUISITE

STUDENT LEARNING OUTCOMES

Upon satisfactory completion of the course students will be able to:

1. Value the concept of individualized evidence-based exercise prescription.
2. Apply the skills of evidence-based practice as they pertain to exercise prescription:
3. Use alternate sources of knowledge (principles of training, physiological knowledge, experience) to inform exercise prescriptions in areas for which research-based evidence is weak or lacking.
4. Describe the dynamics and timescales of the positive and negative physiological and motor adaptations to training and their implications for exercise prescription.
5. Describe the interactions between the elements of a training program.
6. Design well presented and reasoned training plans for all timescales (set, workout, microcycle, mesocycle, macrocycle)
7. Use metrics of exercise stress computed from real-time exercise monitoring devices to estimate training loads.
8. Implement scientific methods for individualizing exercise prescriptions:
9. Use the impulse-response model in training analysis and optimization.
10. Coach the technique of principal strength and power exercises, invoking the principles of goal setting, progression, learning modes, observation, feedback, and practice.
11. Practice the movement assessment and corrective exercises common to active rehabilitation.
12. Prescribe exercise in different professional settings (sport coaching, clinical exercise physiology, rehabilitation, personal and small-group training, strength & conditioning)
13. Apply professional skills:

FEES

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

RESOURCES

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

OTHER IMPLICATIONS

Articulation agreement reviewed?	◯ YES	◯ NO	◉ Not applicable
Exam required:	◉ YES	◯ NO	
Criminal Record Check required:	◯ YES	◉ NO	

APPROVALS: APPROVAL IS SIGNIFIED BY DATE AND APPROPRIATE SIGNATURE.

1   Departmental approval indicates that the Department or School has approved the content of the course, and has consulted with other Departments/Schools/Faculties regarding proposed course content and overlap issues.

_____   _____

Chair, Department/School   Date

_____   _____

Chair, Faculty Curriculum Committee   Date

2   Faculty approval indicates that all the necessary course content and overlap concerns have been resolved, and that the Faculty/School/Department commits to providing the required Library funds.

_____   _____

Dean or designate   Date

LIST which other Departments, Schools and Faculties have been consulted regarding the proposed course content, including overlap issues. Attach documentary evidence of responses.

No other deparments offer courses in this area.

Other Faculties' approval indicates that the Dean(s) or Designate of other Faculties AFFECTED by the proposed new course support(s) the approval of the new course:

_____ Date _____

_____ Date _____

3   SCUS approval indicates that the course has been approved for implementation subject, where appropriate, to financial issues being addressed.

COURSE APPROVED BY SCUS (Chair of SCUS):

_____ Date _____

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

☐ Course number   ☐ Credit   ☐ Title   ☐ Description   ☐ Prerequisite   ☑ Course deletion   ☐ Learning Outcomes

Indicate number of hours for: Lecture _____   Seminar _____   Tutorial _____   Lab _____

FROM
Course Subject/Number **BPK 344**

Credits **Exercise Prescription**

TO
Course Subject/Number _____

Credits _____

TITLE

(1) LONG title for calendar and schedule, no more than 100 characters including spaces and punctuation.
FROM: TO:

(2) SHORT title for enrollment and transcript, no more than 30 characters including spaces and punctuation.
FROM: TO:

DESCRIPTION
FROM:

Scientific principles relevant to the design of safe and effective conditioning programs for both the general population and target groups. Students will learn effective training techniques for cardiovascular aerobic conditioning; muscular endurance, strength, and power; anaerobic conditioning, and flexibility. Safety, injury prevention, rehabilitation, reconditioning, and correct weightlifting mechanics will be discussed.

DESCRIPTION
TO:

PREREQUISITE

Does this course replicate the content of a previously approved course to such an extent that students should not receive credit for both courses? If so, this should be noted in the prerequisite.

FROM: ·

PREREQUISITE

TO:

LEARNING OUTCOMES

RATIONALE

BPK 344 Exercise Prescription(3) is being replaced by BPK 443 Advanced Exercise Prescription (3). The course now uses primary research articles and has additional third year prerequisite (304W, 310) in scientific inquiry which warrant the course being offered at the fourth year level.

Effective term and year
Fall 2015

SFU
SENATE COMMITTEE ON
UNDERGRADUATE STUDIES

COURSE SUBJECT Chemistry   **NUMBER** 433

COURSE TITLE

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

Bioinorganic Chemistry

AND

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

Bioinorganic Chemistry

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

COURSE DESCRIPTION (FOR CALENDAR). 50 WORDS MAXIMUM. ATTACH A COURSE OUTLINE TO THIS PROPOSAL

An overview of the roles of metal ions in biological systems, from trace elements, to enzymes, to medicinal inorganic chemistry.

REPEAT FOR CREDIT ■ YES ☐ NO   How many times? 1   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 a library report and, if appropriate, confirmation that funding arrangements have been addressed.

Library report status, see lib.sfu.ca/collections/course-assessments | Identical needs to CHEM 333, a long-standing course being deleted |

RATIONALE FOR INTRODUCTION OF THIS COURSE

If more space is needed, please use the provided text box on page 4 of this document

A more advanced version of bioinorganic chemistry (compared to the discontinued CHEM 333) with a 3rd year CHEM 332 prerequisite has been offered annually for the past 4 years as a CHEM 439 (Special Topics) course. Given the regularity of this offering, it is now appropriate to designate the course with its own course number. Adding an alternative UD division MBB prerequisite option allows senior MBB students to also access the course.

SCHEDULING AND ENROLLMENT INFORMATION

Term and year course would first be offered (e.g. FALL 2014) and planned **frequency** (e.g. each semester) of offering thereafter:

Fall 2015, once per year maximum

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

What is the probable enrollment when offered?   Estimate: 30

UNITS

Indicate number of units: 3

Indicate no. of contact hours for: 3 | Lecture | | Seminar | | Tutorial | | Lab | | Other – please explain

OTHER

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

Storr and Warren both regularly teach this course (as a special-topics offering)

WQB DESIGNATION (attach approval from Curriculum Office)

None

PREREQUISITE AND / OR COREQUISITE

CHEM 332; or at least 6 units of upper-division MBB courses; or permission of the Department

EQUIVALENT COURSES

Does this course replicate the content of a previously-approved course to such an extent that students should not receive credit for both courses?

CHEM 333

COURSE – LEVEL EDUCATIONAL GOALS (OPTIONAL)

FEES

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

RESOURCES

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

None

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

Daniel Leznoff, Chemistry Undergraduate Studies Committee Chair

SFU

COURSE SUBJECT/NUMBER Science 191

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

Introduction to Modern Scientific Research

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

Modern Scientific Research

CAMPUS where course will be taught: [✓] Burnaby [ ] Surrey [ ] Vancouver [ ] Great Northern Way [ ] Off campus

COURSE DESCRIPTION (FOR CALENDAR). 50-60 WORDS MAXIMUM. ATTACH A COURSE OUTLINE TO THIS PROPOSAL.

Introduction to research being performed in the Faculty of Science. Students attend bi-weekly seminars in which current research topics in the Faculty of Science are introduced at a level suitable for first-year students. This course spans disciplines in the Faculty of Science.

REPEAT FOR CREDIT (●) NO ( ) YES How many times?   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 a library report and, if appropriate, confirmation that funding arrangements have been addressed.

approved

Library report status

RATIONALE FOR INTRODUCTION OF THIS COURSE

First year science students generally do not get exposed to the breadth of research topics being pursued in their own university. As such, some of the advantages of attending a major research university are not evident until 3rd or 4th year. This course provides a survey of ongoing research topics from the many departments within the Faculty of Science. It is a 1-credit full-year (September-April) course with grades determined by attendence and preparation of short summaries of a selection of the seminars. We propose that the IP grade be utilized at the end of the first term, with the final grade awarded at the end of the second term (normally April).

SCHEDULING AND ENROLLMENT INFORMATION
Indicate effective **term** and **year** course would first be offered and planned **frequency** of offering thereafter:

First offering in September 2015. Offered annually. It is proposed to use the IP grade at the end of the first term (normally December), with the final grade awarded after two terms (normally April). ⊞

Will this be a required or elective course in the curriculum? ( ) Required (●) Elective

What is the probable enrollment when offered? Estimate:

50

CREDITS

Indicate number of credits (units): 1

Indicate number of hours for: Lecture Seminar Tutorial Lab Other

1

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

All research faculty in the Faculty of Science.

WQB DESIGNATION (attach approval from Curriculum Office)

None

PREREQUISITE

Does this course replicate the content of a previously-approved course to such an extent that students should not receive credit for both courses? If so, this should be **noted in the prerequisite**.

None

COREQUISITE

None

STUDENT LEARNING OUTCOMES

Upon satisfactory completion of the course students will be able to:

Students will develop an appreciation of the breadth of scientific research being undertaken at SFU. They will also better understand the possibilities made available by a science degree before choosing their major.

FEES

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

SFU

RESOURCES

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

None.

OTHER IMPLICATIONS

Articulation agreement reviewed?	◯ YES ◯ NO	● Not applicable
Exam required:	◯ YES ● NO	
Criminal Record Check required:	◯ YES ● NO	

APPROVALS: APPROVAL IS SIGNIFIED BY DATE AND APPROPRIATE SIGNATURE.

1   Departmental approval indicates that the Department or School has approved the content of the course, and has consulted with other Departments/Schools/Faculties regarding proposed course content and overlap issues.

_____   _____
Chair, Department/School   Date

_____   _____
Chair, Faculty Curriculum Committee   Date

2   Faculty approval indicates that all the necessary course content and overlap concerns have been resolved, and that the Faculty/School/Department commits to providing the required Library funds.

_____   _____
Dean or designate   Date

LIST which other Departments, Schools and Faculties have been consulted regarding the proposed course content, including overlap issues. Attach documentary evidence of responses.

This course does not overlap with any other course at SFU.

Other Faculties' approval indicates that the Dean(s) or Designate of other Faculties AFFECTED by the proposed new course support(s) the approval of the new course:

_____ Date _____

_____ Date _____

3   SCUS approval indicates that the course has been approved for implementation subject, where appropriate, to financial issues being addressed.

COURSE APPROVED BY SCUS (Chair of SCUS):

_____ Date _____

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

☐ Course number   ☐ Credit   ☐ Title   ☐ Description   ☑ Prerequisite   ☐ Course deletion   ☐ Learning Outcomes

Indicate number of hours for: Lecture _____   Seminar_____   Tutorial _____   Lab _____

FROM   STAT 475
Course Subject/Number_____

TO
Course Subject/Number _____

Credits _____

Credits_____

TITLE
(1) LONG title for calendar and schedule, no more than 100 characters including spaces and punctuation.
FROM: **TO:**
Applied Discrete Data Analysis

(2) SHORT title for enrollment and transcript, no more than 30 characters including spaces and punctuation.
FROM: **TO:**

DESCRIPTION
FROM:

DESCRIPTION
TO:

PREREQUISITE
Does this course replicate the content of a previously approved course to such an extent that students should not receive credit for both courses? If so, this should be **noted in the prerequisite**.

FROM: STAT 285 or STAT 302 or STAT 305

PREREQUISITE

TO: STAT 302 or STAT 305 or STAT 350

LEARNING OUTCOMES

RATIONALE
STAT-475 requires students to have received the training in linear regression analysis provided in STAT-350 or STAT-302 or STAT-305, which is beyond the usual coverage of regression analysis in STAT-285.

Effective term and year Spring 2015

NOVEMBER 2012

SFU

COURSE NUMBER MATH 498-1

COURSE TITLE

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

Communication and Research Skills in the Mathematical Sciences

AND

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

Communication/Research Skills

CREDITS

Indicate number of credits for: Lecture __1__   Seminar _____   Tutorial _____   Lab _____

COURSE DESCRIPTION (FOR CALENDAR). 3-4 LINES MAXIMUM. ATTACH A COURSE OUTLINE TO THIS PROPOSAL.

Students will develop skills required for mathematical research. This course will focus on communication in both written and oral form. Students will write documents and prepare presentations in a variety of formats for academic and non-academic purposes. The LaTeX document preparation system will be used. Course will be given on a pass/fail basis.

PREREQUISITE

COREQUISITE

MATH 499W

SPECIAL INSTRUCTIONS

That is, does this course replicate the content of a previously-approved course to such an extent that students should not receive credit for both courses.? If so, this should be **noted in the prerequisiite**.

COURSES(S) TO BE DELETED IF THIS COURSE IS APPROVED
NOTE: APPROPRIATE DOCUMENT FOR DELETION MUST BE SUBMITTED TO SCUS

RATIONALE FOR INTRODUCTION OF THIS COURSE

The Department of Mathematics wishes to offer an undergraduate thesis in Mathematics for students in all of our Honors programs. The thesis will consist of two components, this course, which will be taught as a lecture based course and MATH 499W-5 Honors Research Project which will be individually supervised.

SCHEDULING AND ENROLLMENT INFORMATION

Indicate effective **term and year** course would first be offered and planned **frequency** of offering thereafter:

Fall 2015. Every Fall.

(NOTE: There is a two-term wait for implementation of any new course.)

Indicate if there is a waiver required: ☐ YES ☑ NO   Will this be a required or elective course in the curriculum? ☑ Required ☐ Elective

What is the probable enrollment when offered?   Estimate 5-10

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

All mathematics research faculty

Are there any proposed student fees associated with this course other than tuition fees?   ☐ YES ☑ NO
(If yes, attach mandatory supplementary fee approval form.)

RESOURCE IMPLICATIONS

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 a library report and, if appropriate, confirmation that funding arrangements have been addressed.

Campus where course will be taught Burnaby

Library report status

Provide details on how existing instructional resources will be redistributed to accommodate this new course. For example, will another course be eliminated or will the frequency of offering of other courses be reduced; are there changes in pedagogical style or class sizes that allow for this additional course offering?

We will reduce the offering frequency of our 300 and 400 level MATH special topics courses.

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

None

Articulation agreement reviewed?   ☐ YES ☐ NO   ☑ Not applicable

OTHER IMPLICATIONS

None

SFU

COURSE NUMBER MATH 499W-5

COURSE TITLE

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

Honours Research Project

AND

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

Honours Research Project

CREDITS

Indicate number of credits for: Lecture ___5___ Seminar _____ Tutorial _____ Lab _____

COURSE DESCRIPTION (FOR CALENDAR). 3-4 LINES MAXIMUM. ATTACH A COURSE OUTLINE TO THIS PROPOSAL.

An honours research project in mathematics is an original presentation of an area or problem in mathematics. A typical project is an original synthesis of knowledge generated from student research experience. A project can contain substantive, original mathematics, but need not.

The presentation consists of a written report and an oral presentation both of which must be completed before the end of the exam period.

PREREQUISITE

18 credits of upper division MATH or MACM courses. Must be in an honours program with a GPA of at least 3.0.

COREQUISITE

MATH 498

SPECIAL INSTRUCTIONS

That is, does this course replicate the content of a previously-approved course to such an extent that students should not receive credit for both courses.? If so, this should be **noted in the prerequisiite.**

COURSES(S) TO BE DELETED IF THIS COURSE IS APPROVED
NOTE: APPROPRIATE DOCUMENT FOR DELETION MUST BE SUBMITTED TO SCUS

RATIONALE FOR INTRODUCTION OF THIS COURSE

The Department of Mathematics wishes to offer an undergraduate thesis in Mathematics for students in all of our Honors programs. The thesis will consist of two components, this course, which contains the main written thesis component and which will be individually supervised, and MATH 498-1 Communication and Research Skills in the Mathematical Sciences which will be taught as a lecture based course.

SCHEDULING AND ENROLLMENT INFORMATION

Indicate effective **term and year** course would first be offered and planned **frequency** of offering thereafter:

Fall 2015. Every Fall.

(NOTE: There is a two-term wait for implementation of any new course.)

Indicate if there is a waiver required: ☐ YES ☑ NO   Will this be a required or elective course in the curriculum? ☑ Required ☐ Elective

What is the probable enrollment when offered?   Estimate ___5-10___

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

All mathematics research faculty

Are there any proposed student fees associated with this course other than tuition fees?   ☐ YES ☑ NO
(If yes, attach mandatory supplementary fee approval form.)

RESOURCE IMPLICATIONS

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 a library report and, if appropriate, confirmation that funding arrangements have been addressed.

Campus where course will be taught ___Burnaby___

Library report status___

Provide details on how existing instructional resources will be redistributed to accommodate this new course. For example, will another course be eliminated or will the frequency of offering of other courses be reduced; are there changes in pedagogical style or class sizes that allow for this additional course offering?

None needed. Students will be individually supervised by research faculty for no teaching credit.

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

None

Articulation agreement reviewed?   ☐ YES ☐ NO   ☑ Not applicable

OTHER IMPLICATIONS

None

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Canada V5A 1S6   FAX: 778.782.5876   www.sfu.ca/ugcr

MEMORANDUM

ATTENTION	Claire Cupples, Dean, Faculty of Science	**DATE**	December 9, 2014
FROM	Susan Rhodes, Director University Curriculum & Institutional Liaison	**PAGES**	1
RE:	MATH W designation approval		

The University Curriculum Office has approved **W** designation for the following proposed new Faculty of Science course, effective Fall 2015 (1157):

MATH 499-5 Honours Research Project

This course will be offered with a proposed co-requisite, MATH 498-1 Communications and Research Skills in the Mathematical Sciences, which, combined, will provide students with skill development in disciplinary writing and presentation of research.

cc: Michael Monagan, Mathematics Undergraduate Chair

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

■ Course number ☐ Credit ☐ Title ■ Description ■ Prerequisite ☐ Course deletion ☐ Learning Outcomes

Indicate number of hours for: Lecture ___3___ Seminar_____ Tutorial _____ Lab _____

FROM
Course Subject/Number_____MATH 370W_____

TO
Course Subject/Number _____MATH 480W_____

Credits ___3___

Credits ___3___

TITLE

(1) LONG title for calendar and schedule, no more than 100 characters including spaces and punctuation.
FROM: **TO:**

(2) SHORT title for enrollment and transcript, no more than 30 characters including spaces and punctuation.
FROM: **TO:**

DESCRIPTION
FROM:

Designed for students with a strong interest in problem solving and the determination to persevere in seeking solutions to highly challenging mathematical problems. Intended as a preparation for the Putnam Competition, the most challenging and prestigious undergraduate mathematics competition in North America, in which effective presentation of solutions is as important as skill in problem solving. Develops problem solving skills, including confidence, persistence, and willingness to experiment freely as well as to pursue rigorous argument. Reviews strategic principles, tactical approaches, and specific technical tools for problem solving, and mathematical problem solving folklore. Emphasis is placed on clarity of exposition and persuasiveness of written argument, and on development of communication skills.

DESCRIPTION
TO:

Designed for students with a strong interest in problem solving and the determination to persevere in seeking solutions to highly challenging mathematical problems. Intended a preparation for the Putnam Competition, the most challenging and prestigious undergraduate mathematics competition in North America, in which effective presentation of solutions is as important as skill in problem solving. Reviews strategic principles, tactical approaches, and specific technical tools for problem solving, and mathematical problem solving folklore. Emphasis is placed on clarity of exposition and persuasiveness of written argument, and on development of communication skills. Students interested in MATH 480W are encouraged to take the course as soon as they meet the prerequisites, since performance in the Putnam Competition often improves with second and subsequent attempts.

PREREQUISITE

Does this course replicate the content of a previously approved course to such an extent that students should not receive credit for both courses?
If so, this should be **noted in the prerequisite**.

FROM: MACM 201 with a grade of at least B. At least one of MACM 201, MATH 240, MATH 242, MATH 251, or MATH 252 with a grade of at least A, or two of MACM 203, MACM 204, and MATH 294 each with a grade of at least A. Or permission of the instructor.

PREREQUISITE

TO: MACM 201 with a grade of at least B. At least one of MACM 201, MATH 240, MATH 242, MATH 251, MATH 252 with a grade of at least A, or both of MACM 203, MACM 204 with a grade of at least A. Or permission of the instructor. Students with credit for MATH 370W may not take MATH 480W for credit.

LEARNING OUTCOMES

RATIONALE

The course is designed to prepare students to sit the annual Putnam Competition, the most challenging and prestigious undergraduate mathematics competition in North America. This is to request that MATH 370W be reclassified as MATH 480W, because the level of mathematical maturity required to benefit fully from the course is better suited to the 400 level than the 300 level. This view is supported by students who have taken the course since it was first offered in Fall 2006, indicating that it is widely considered to be one of the most challenging mathematics courses offered at SFU.

Effective term and year
Fall 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

■ Course number ☐ Credit ☐ Title ■ Description ■ Prerequisite ☐ Course deletion ☐ Learning Outcomes

Indicate number of hours for: Lecture **3** _____ Seminar_____ Tutorial _____ Lab _____

FROM
Course Subject/Number **MATH 370W**

TO
Course Subject/Number **MATH 480W**

Credits **3**

Credits **3**

TITLE

(1) LONG title for calendar and schedule, no more than 100 characters including spaces and punctuation.
FROM: TO:

(2) SHORT title for enrollment and transcript, no more than 30 characters including spaces and punctuation.
FROM: TO:

DESCRIPTION
FROM:

Designed for students with a strong interest in problem solving and the determination to persevere in seeking solutions to highly challenging mathematical problems. Intended as a preparation for the Putnam Competition, the most challenging and prestigious undergraduate mathematics competition in North America, in which effective presentation of solutions is as important as skill in problem solving. Develops problem solving skills, including confidence, persistence, and willingness to experiment freely as well as to pursue rigorous argument. Reviews strategic principles, tactical approaches, and specific technical tools for problem solving, and mathematical problem solving folklore. Emphasis is placed on clarity of exposition and persuasiveness of written argument, and on development of communication skills.

DESCRIPTION
TO:

Designed for students with a strong interest in problem solving and the determination to persevere in seeking solutions to highly challenging mathematical problems. Intended as a preparation for the Putnam Competition, the most challenging and prestigious undergraduate mathematics competition in North America, in which effective presentation of solutions is as important as skill in problem solving. Reviews strategic principles, tactical approaches, and specific technical tools for problem solving, and mathematical problem solving folklore. Emphasis is placed on clarity of exposition and persuasiveness of written argument, and on development of communication skills. Students interested in MATH 480W are encouraged to take the course as soon as they meet the prerequisites, since performance in the Putnam Competition often improves with second and subsequent attempts.

PREREQUISITE

Does this course replicate the content of a previously approved course to such an extent that students should not receive credit for both courses?
If so, this should be **noted in the prerequisite**.

FROM: MACM 201 with a grade of at least B. At least one of MACM 201, MATH 240, MATH 242, MATH 251, or MATH 252 with a grade of at least A, or two of MACM 203, MACM 204, and MATH 294 each with a grade of at least A. Or permission of the instructor.

PREREQUISITE

TO: MACM 201 with a grade of at least B. At least one of MACM 201, MATH 240, MATH 242, MATH 251, MATH 252 with a grade of at least A, or both of MACM 203, MACM 204 with a grade of at least A. Or permission of the instructor. Students with credit for MATH 370W may not take MATH 480W for credit.

LEARNING OUTCOMES

RATIONALE

The course is designed to prepare students to sit the annual Putnam Competition, the most challenging and prestigious undergraduate mathematics competition in North America. This is to request that MATH 370W be reclassified as MATH 480W, because the level of mathematical maturity required to benefit fully from the course is better suited to the 400 level than the 300 level. This view is supported by students who have taken the course since it was first offered in Fall 2006, indicating that it is widely considered to be one of the most challenging mathematics courses offered at SFU.

Effective term and year
Fall 2015

SENATE COMMITTEE ON
UNDERGRADUATE STUDIES

COURSE CHANGE/DELETION

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

☐ Course number   ☐ Credit   ☐ Title   ☐ Description   ☑ Prerequisite   ☐ Course deletion   ☐ Learning Outcomes

Indicate number of hours for: Lecture __3__   Seminar_____   Tutorial _____   Lab _____

FROM
Course Subject/Number_MACM 201_____

TO
Course Subject/Number _MACM 201_____

Credits __3_____

Credits_3_____

TITLE
(1) LONG title for calendar and schedule, no more than 100 characters including spaces and punctuation.
FROM: **TO:**

(2) SHORT title for enrollment and transcript, no more than 30 characters including spaces and punctuation.
FROM: **TO:**

DESCRIPTION   **DESCRIPTION**
FROM: **TO:**

PREREQUISITE
Does this course replicate the content of a previously approved course to such an extent that students should not receive credit for both courses? If so, this should be **noted in the prerequisite.**

FROM: MACM 101

PREREQUISITE

TO: MACM 101 or (ENSC 251 and one of MATH 232 or MATH 240)

LEARNING OUTCOMES

RATIONALE

Engineering and Mathematics have agreed that Engineering students who have completed both ENSC 251 Software Design and Analysis for Engineers, and either MATH 232 Applied Linear Algebra or MATH 240 Algebra I: Linear Algebra, have a sufficient preparation for MACM 201 Discrete Mathematics II.

Effective term and year   Fall 2015

Motion II:
To change the lower and upper division requirements for the Mathematics Honours Program

From (Lower and Upper Division Requirements for the Mathematics Honours Program):

Students complete 132 units, as specified below.

Lower Division Requirements

Students complete either one of
CMPT 126 - Introduction to Computing Science and Programming (3)
CMPT 128 - Introduction to Computing Science and Programming for Engineers (3)

or both of
CMPT 120 - Introduction to Computing Science and Programming I (3)
CMPT 125 - Introduction to Computing Science and Programming II (3)

or both of
CMPT 130 - Introduction to Computer Programming I (3)
CMPT 135 - Introduction to Computer Programming II (3)

and all of
CMPT 225 - Data Structures and Programming (3)
MACM 101 - Discrete Mathematics I (3)
MACM 201 - Discrete Mathematics II (3)
MACM 203 - Computing with Linear Algebra (2) +
MACM 204 - Computing with Calculus (2) +
MATH 242 - Introduction to Analysis I (3)
MATH 251 - Calculus III (3)
MATH 252 - Vector Calculus (3)
STAT 270 - Introduction to Probability and Statistics (3)

and one of
MATH 150 - Calculus I with Review (4)
MATH 151 - Calculus I (3) *
MATH 154 - Calculus I for the Biological Sciences (3) **
MATH 157 - Calculus I for the Social Sciences (3) **

and one of
MATH 152 - Calculus II (3) *
MATH 155 - Calculus II for the Biological Sciences (3) **

MATH 158 - Calculus II for the Social Sciences (3) **

and one of
MATH 232 - Applied Linear Algebra (3) **
MATH 240 - Algebra I: Linear Algebra (3) *

+The following substitutions are also permitted.
They may not be used to satisfy the upper division requirements below.
MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3) for MACM 203.

MACM 401 - Introduction to Computer Algebra (3) for MACM 204.

MACM 442 - Cryptography (3) for MACM 204.
* strongly recommended
** with a B grade or better

Upper Division Requirements

Students complete a total of 60 upper division units. 48 units will satisfy requirements for the mathematics honours program. 36 units must include upper division MATH and MACM coursework, including:

MATH 340 - Algebra II: Rings and Fields (3)
MATH 341 - Algebra III: Groups (3)

and one of
MATH 343 - Applied Discrete Mathematics (3)
MATH 345 - Introduction to Graph Theory (3)
MATH 447 - Coding Theory (3)
MATH 408 - Discrete Optimization (3)
MATH 443 - Combinatorial Theory (3)

and one of
MATH 320 - Introduction to Analysis II (3)
MATH 322 - Complex Variables (3)

and one of
MATH 338 - Advanced Linear Algebra (3)
MATH 342 - Elementary Number Theory (3)

and one of
MATH 310 - Introduction to Ordinary Differential Equations (3)
MACM 316 - Numerical Analysis I (3)

The remaining 12 units may be additional MATH and MACM coursework or may be chosen from the following course list:

PHYS 413 - Advanced Mechanics (3)
STAT 330 - Introduction to Mathematical Statistics (3)
STAT 340 - Introduction to Statistical Computing and Exploratory Data Analysis (3)
STAT 350 - Linear Models in Applied Statistics (3)
STAT 380 - Introduction to Stochastic Processes (3)
STAT 430 - Statistical Design and Analysis of Experiments (3)
STAT 445 - Applied Multivariate Analysis (3)
STAT 450 - Statistical Theory (3)
STAT 460 - Bayesian Statistics (3)
STAT 475 - Applied Discrete Data Analysis (3)
STAT 485 - Applied Time Series Analysis (3)

At least five courses will be from 400 division courses, of which at least three courses will be in 400 division MATH or MACM courses. Directed studies, job practicum, or honours essay courses cannot be used to fulfil the 400 division requirement. Students are also required to complete an additional 12 upper division units chosen from any courses.
In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.

Elective Courses

In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.
Students obtain at least six units in courses offered by the Faculty of Science outside the Department of Mathematics, and the Department of Statistics and Actuarial Science. Courses PHYS 100, BISC 100 and CHEM 110/111 cannot be used to satisfy this requirement. Students will also obtain at least six units in Faculty of Arts and Social Sciences courses. (The two required CMPT courses and the Faculty of Arts and Social Sciences six-unit requirement fulfill the Faculty of Science requirement that students complete 12 units from outside the Faculty of Science.)

Other Requirements

Of the total 132 units required for the honours, at least 12 units must be completed outside the Faculty of Science including at least six in the Faculty of Arts and Social Sciences. At least 60 units must be from the upper division. A cumulative grade point average (CGPA) of at least 3.00 and an upper division grade point average of at least 3.00 are required. These averages are

calculated on all courses completed at the University. If both averages are at least 3.50, the designation 'first class' applies.

To (Lower and Upper Division Requirements for the Mathematics Honours Program):

Students complete 120 units, as specified below.

Lower Division Requirements

Students complete either one of
CMPT 126 - Introduction to Computing Science and Programming (3)
CMPT 128 - Introduction to Computing Science and Programming for Engineers (3)

or both of
CMPT 120 - Introduction to Computing Science and Programming I (3)
CMPT 125 - Introduction to Computing Science and Programming II (3)

or both of
CMPT 130 - Introduction to Computer Programming I (3)
CMPT 135 - Introduction to Computer Programming II (3)

and all of
~~CMPT 225 - Data Structures and Programming (3)~~
MACM 101 - Discrete Mathematics I (3)
MACM 201 - Discrete Mathematics II (3)
MACM 203 - Computing with Linear Algebra (2) +
MACM 204 - Computing with Calculus (2) +
MATH 242 - Introduction to Analysis I (3)
MATH 251 - Calculus III (3)
MATH 252 - Vector Calculus (3)
STAT 270 - Introduction to Probability and Statistics (3)

and one of
MATH 150 - Calculus I with Review (4)
MATH 151 - Calculus I (3) *
MATH 154 - Calculus I for the Biological Sciences (3) **
MATH 157 - Calculus I for the Social Sciences (3) **

and one of
MATH 152 - Calculus II (3) *

MATH 155 - Calculus II for the Biological Sciences (3) **
MATH 158 - Calculus II for the Social Sciences (3) **

and one of
MATH 232 - Applied Linear Algebra (3) **
MATH 240 - Algebra I: Linear Algebra (3) *

and at least one of
CMPT 225 - Data Structures and Programming (3)
STAT 285 - Intermediate Probability and Statistics (3)

+The following substitutions are also permitted. They may not be used to satisfy the upper division requirements below.

MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3) for MACM 203.

MACM 401 - Introduction to Computer Algebra (3) for MACM 204.

MACM 442 - Cryptography (3) for MACM 204.

* strongly recommended

** with a B grade or better

Upper Division Requirements

Students complete at least 48 units of which at least 15 must be at the 400 level.
Students complete all of

MATH 310 - Introduction to Ordinary Differential Equations (3)
MATH 320 - Introduction to Analysis II (3)
MATH 322 - Complex Variables (3)
MATH 340 - Algebra II: Rings and Fields (3)
MATH 341 - Algebra III: Groups (3)
MATH 498 - Communication and Research Skills in the Mathematical Sciences (1)
MATH 499W - Honours Research Project (5)

and one of
MATH 343 - Applied Discrete Mathematics (3)
MATH 345 - Introduction to Graph Theory (3)

MATH 408 - Discrete Optimization (3)
MATH 443 - Combinatorial Theory (3)
MATH 447 - Coding Theory (3)

and one of
MATH 320 - Introduction to Analysis II (3)
MATH 322 - Complex Variables (3)

and one of
MATH 338 - Advanced Linear Algebra (3)
MATH 342 - Elementary Number Theory (3)

and one of
MATH 310 - Introduction to Ordinary Differential Equations (3)
MACM 316 - Numerical Analysis I (3)

In addition to the above core requirement of 24 units, students must complete the requirements for at least one of the three concentrations below.

Algebra and Number Theory Concentration

Students complete at least 9 units from the following list of which at least 3 units must be at the 400 level.

MATH 338 Advanced Linear Algebra (3)
MATH 342 Elementary Number Theory (3)
MATH 440 Galois Theory (3)
MATH 441 Commutative Algebra and Algebraic Geometry (3)
MATH 443 Combinatorial Theory (3)
MATH 447 Coding Theory (3)
MACM 401 Introduction to Computer Algebra (3)
MACM 442 Cryptography (3)

Analysis and Optimization Concentration

Students complete at least 9 units from the following list of which at least 3 units must be at the 400 level.

MACM 316 Numerical Analysis I (3)
MATH 308 Linear Optimization (3)
MATH 309 Continuous Optimization (3)
MATH 314 Boundary Value Problems (3)
MATH 408 Discrete Optimization (3)

MATH 418 Partial Differential Equations (3)
MATH 419 Linear Analysis (3)
MATH 424 Applications of Complex Analysis (3)
MATH 425 Real Analysis (3)

Discrete Mathematics Concentration

Students complete

CMPT 225 Data Structures and Programming (3)

and at least 9 units from the following list
of which at least 3 units must be at the 400 level.

MACM 442 Cryptography (3)
MATH 343 - Applied Discrete Mathematics (3)
MATH 345 - Introduction to Graph Theory (3)
MATH 408 - Discrete Optimization (3)
MATH 443 - Combinatorial Theory (3)
MATH 445 - Graph Theory (3)
MATH 447 - Coding Theory (3)
MATH 448 - Network Flows (3)
CMPT 307 - Data Structures and Algorithms (3)
CMPT 405 - Design and Analysis of Computer Algorithms (3)

Additional Electives.

Students must complete an additional 15 upper division units.
These units can be any upper division MATH or MACM courses
or taken from the following list

STAT 380 Introduction to Stochastic Processes (3)
PHYS 413 Advanced Mechanics (3)

They may include additional courses from the three Concentrations.
The total number of 400 level units must be at least 15.

Science Electives

~~In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.~~
Students obtain at least six units in courses offered by the Faculty of Science outside the Department of Mathematics, and the Department of Statistics and Actuarial Science. Courses PHYS 100, BISC 100 and CHEM 110/111 cannot be

used to satisfy this requirement. ~~Students will also obtain at least six units in Faculty of Arts and Social Sciences courses. (The two required CMPT courses and the Faculty of Arts and Social Sciences six-unit requirement fulfill the Faculty of Science requirement that students complete 12 units from outside the Faculty of Science.)~~

Other Requirements

<u>Of the total 120 units required for the honours,</u> ~~at least 12 units must be completed outside the Faculty of Science including at least six in the Faculty of Arts and Social Sciences.~~ at least 60 units must be from the upper division. A cumulative grade point average (CGPA) of at least 3.00 and an upper division grade point average of at least 3.00 are required. These averages are calculated on all courses completed at the University.

Rationale:

Currently the number of students enrolled in the mathematics honours program is low and decreasing. The department wishes to increase the number from 5 per year to 10 per year. The three main changes, (1) reducing the total credit requirement from 132 credits to 120 credits, (2) adding an honours research opportunity with MATH 498-1 and MATH 499W-5, and (3) adding three streams which list many of our mathematics courses, are aimed at making the degree stronger, more attractive, and providing better direction. MATH 498-1 and 499W-5 provide students with a research opportunity. They will also help us build an honours cohort which was recommended to us by the departmental external review committee in 2014.

Motion III:
To change the lower and upper division requirements for the Applied Mathematics Honours Program

From (Lower and Upper Division Requirements for the Applied Mathematics Honours Program):

Students complete 132 units, as specified below.

Lower Division Requirements

Students complete 40-44 units, including either one of
CMPT 126 - Introduction to Computing Science and Programming (3)
CMPT 128 - Introduction to Computing Science and Programming for Engineers (3)

or both of
CMPT 120 - Introduction to Computing Science and Programming I (3)
CMPT 125 - Introduction to Computing Science and Programming II (3)

or both of
CMPT 130 - Introduction to Computer Programming I (3)
CMPT 135 - Introduction to Computer Programming II (3)

and all of
MACM 203 - Computing with Linear Algebra (2) +
MACM 204 - Computing with Calculus (2) +
CMPT 225 - Data Structures and Programming (3)
MATH 242 - Introduction to Analysis I (3)
MATH 251 - Calculus III (3)
MATH 252 - Vector Calculus (3)
PHYS 211 - Intermediate Mechanics (3)
STAT 270 - Introduction to Probability and Statistics (3)

and one of
PHYS 120 - Mechanics and Modern Physics (3)
PHYS 125 - Mechanics and Special Relativity (3)
PHYS 140 - Studio Physics - Mechanics and Modern Physics (4)

and one of
PHYS 121 - Optics, Electricity and Magnetism (3)
PHYS 126 - Electricity, Magnetism and Light (3)
PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4)

and one of
MATH 150 - Calculus I with Review (4)
MATH 151 - Calculus I (3) *
MATH 154 - Calculus I for the Biological Sciences (3) **
MATH 157 - Calculus I for the Social Sciences (3) **

and one of
MATH 152 - Calculus II (3) *
MATH 155 - Calculus II for the Biological Sciences (3) **
MATH 158 - Calculus II for the Social Sciences (3) **

and one of
MATH 232 - Applied Linear Algebra (3) **
MATH 240 - Algebra I: Linear Algebra (3) *

+ The following substitutions are also permitted.
They may not be used to satisfy the upper division requirements below.
MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and
Applications (3) for MACM 203.
MACM 401 - Introduction to Computer Algebra (3) for MACM 204.
MACM 442 - Cryptography (3) for MACM 204.

* strongly recommended
** with a B grade or better

Upper Division Requirements

Students complete 48 units, including all of
MACM 316 - Numerical Analysis I (3)
MATH 310 - Introduction to Ordinary Differential Equations (3)
MATH 314 - Introduction to Fourier Methods and Partial Differential Equations (3)
MATH 320 - Introduction to Analysis II (3)
MATH 322 - Complex Variables (3)
MATH 418 - Partial Differential Equations (3)

and at least one of
MATH 461 - Continuous Mathematical Models (3)
MATH 462 - Fluid Dynamics (3)
MATH 467 - Dynamical Systems (3)

and at least one of
MACM 416 - Numerical Analysis II (3)
MATH 467 - Dynamical Systems (3)

and at least six of
MACM 401 - Introduction to Computer Algebra (3)
MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3)
MATH 308 - Linear Optimization (3)
MATH 309 - Continuous Optimization (3)
MATH 338 - Advanced Linear Algebra (3)
MATH 343 - Applied Discrete Mathematics (3)
MATH 345 - Introduction to Graph Theory (3)
MATH 419 - Linear Analysis (3)
MATH 424 - Complex Analysis (3)
MATH 425 - Real Analysis (3)
MATH 461 - Continuous Mathematical Models (3)
MATH 462 - Fluid Dynamics (3)
MATH 467 - Dynamical Systems (3)
MATH 470 - Variational Calculus (3)
MATH 495 - Selected Topics in Applied Mathematics (3)
PHYS 395 - Computational Physics (3)
PHYS 413 - Advanced Mechanics (3)
STAT 380 - Introduction to Stochastic Processes (3)

and two additional upper division MATH or MACM courses, or any pre-approved quantitative upper division course offered by the Faculties of Applied Sciences, Arts and Social Sciences, Beedie School of Business or Faculty of Science. For this purpose a course, if not MATH or MACM, must be pre-approved by an advisor. Students are encouraged to explore the option of completing courses outside the department and to discuss possibilities with a department advisor.
Choices from the fourth group (at least six of) must not include the courses used to satisfy the second and third groups (at least one of). At least five of the courses used to satisfy the upper division requirements must be at the 400 division.

Other Requirements

Of the total 132 units required for the major, at least 12 must be completed outside the Faculty of Science including at least six in the Faculty of Arts and Social Sciences.
At least 60 of the units must be at the upper division. A cumulative grade point average (CGPA) of at least 3.00 and an upper division grade point average of at least 3.00 are required. These averages are computed on all courses completed at the University. If both averages are at least 3.50, the designation 'first class' applies.

To (Lower and Upper Division Requirements for the Applied Mathematics Honours Program):

Program Requirements

Students complete 120 units, as specified below.

Lower Division Requirements

Students complete 40 units, including either one of
CMPT 126 - Introduction to Computing Science and Programming (3)
CMPT 128 - Introduction to Computing Science and Programming for Engineers (3)

or both of
CMPT 120 - Introduction to Computing Science and Programming I (3)
CMPT 125 - Introduction to Computing Science and Programming II (3)

or both of
CMPT 130 - Introduction to Computer Programming I (3)
CMPT 135 - Introduction to Computer Programming II (3)

and all of
MACM 203 - Computing with Linear Algebra (2) +
MACM 204 - Computing with Calculus (2) +
~~CMPT 225 - Data Structures and Programming (3)~~
MATH 242 - Introduction to Analysis I (3)
MATH 251 - Calculus III (3)
MATH 252 - Vector Calculus (3)
~~PHYS 211 - Intermediate Mechanics (3)~~
STAT 270 - Introduction to Probability and Statistics (3)

and one of
PHYS 120 - Mechanics and Modern Physics (3)
PHYS 125 - Mechanics and Special Relativity (3)
PHYS 140 - Studio Physics - Mechanics and Modern Physics (4)

and one of
PHYS 121 - Optics, Electricity and Magnetism (3)
PHYS 126 - Electricity, Magnetism and Light (3)
PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4)

and one of
MATH 150 - Calculus I with Review (4)

MATH 151 - Calculus I (3) *
MATH 154 - Calculus I for the Biological Sciences (3) **
MATH 157 - Calculus I for the Social Sciences (3) **

and one of
MATH 152 - Calculus II (3) *
MATH 155 - Calculus II for the Biological Sciences (3) **
MATH 158 - Calculus II for the Social Sciences (3) **

and one of
MATH 232 - Applied Linear Algebra (3) **
MATH 240 - Algebra I: Linear Algebra (3) *

and at least one of
CMPT 225 - Data Structures and Programming (3)
ENSC 220 - Electric Circuits I (3)
MACM 201 - Discrete Mathematics II (3)
PHIL 210 - Natural Deductive Logic (3)
PHYS 211 - Intermediate Mechanics (3)
STAT 285 - Intermediate Probability and Statistics (3)

+The following substitutions are also permitted. They may not be used to satisfy the upper division requirements below.

MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3) for MACM 203.

MACM 401 - Introduction to Computer Algebra (3) for MACM 204.

MACM 442 - Cryptography (3) for MACM 204.

* strongly recommended

** with a B grade or better

Upper Division Requirements

Students complete 48 units, including all of

MACM 316 - Numerical Analysis I (3)
MATH 310 - Introduction to Ordinary Differential Equations (3)
MATH 314 - Introduction to Fourier Methods and Partial Differential Equations (3)

MATH 320 - Introduction to Analysis II (3)
MATH 322 - Complex Variables (3)
MATH 418 - Partial Differential Equations (3)
MATH 498 - Communication and Research Skills in the Mathematical Sciences (1)
MATH 499W - Honours Research Project (5)

and at least one of
MATH 308 - Linear Optimization (3)
MATH 309 - Continuous Optimization (3)

and at least one of
MATH 461 - Continuous Mathematical Models (3)
MATH 462 - Fluid Dynamics (3)
MATH 467 - Dynamical Systems (3)

and at least one of
MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3)
MACM 416 - Numerical Analysis II (3)
~~MATH 467 - Dynamical Systems (3)~~
MATH 470 - Variational Calculus (3)

and at least fifteen more upper division units, of which at least three must be chosen from the 400 level. These fifteen units may be selected from any MATH or MACM courses or from

CMPT 464 - Geometric Modelling in Computer Graphics (3)
PHYS 395 - Computational Physics (3)
PHYS 413 - Advanced Mechanics (3)
STAT 380 - Introduction to Stochastic Processes (3).

~~and at least six of~~
~~MACM 401 - Introduction to Computer Algebra (3)~~
~~MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3)~~
~~MATH 308 - Linear Optimization (3)~~
~~MATH 309 - Continuous Optimization (3)~~
~~MATH 338 - Advanced Linear Algebra (3)~~
~~MATH 343 - Applied Discrete Mathematics (3)~~
~~MATH 345 - Introduction to Graph Theory (3)~~
~~MATH 419 - Linear Analysis (3)~~
~~MATH 424 - Complex Analysis (3)~~
~~MATH 425 - Real Analysis (3)~~

MATH 461 - Continuous Mathematical Models (3)
MATH 462 - Fluid Dynamics (3)
MATH 467 - Dynamical Systems (3)
MATH 470 - Variational Calculus (3)
MATH 495 - Selected Topics in Applied Mathematics (3)
PHYS 395 - Computational Physics (3)
PHYS 413 - Advanced Mechanics (3)
STAT 380 - Introduction to Stochastic Processes (3)

and two additional upper division MATH or MACM courses, or any pre-approved
quantitative upper division course offered by the Faculties of Applied Sciences,
Arts and Social Sciences, Beedie School of Business or Faculty of Science. For this
purpose a course, if not MATH or MACM, must be pre-approved by an advisor.
Students are encouraged to explore the option of completing courses outside
the department and to discuss possibilities with a department advisor.
Choices from the fourth group (at least six of) must not include the courses used
to satisfy the second and third groups (at least one of). At least five of the courses
used to satisfy the upper division requirements must be at the 400 division.

Other Requirements

Of the total 120 units required for the honours program, at least 12 must be
completed outside the Faculty of Science including at least six in the Faculty of
Arts and Social Sciences. at least 60 units must be from the upper division. A
cumulative grade point average (CGPA) of at least 3.00 and an upper division
grade point average of at least 3.00 are required. These averages are computed
on all courses completed at the University.

Rationale:

Currently the department has zero students enrolled in the applied mathematics
honours program. The three main changes, (1) reducing the total credit
requirement from 132 credits to 120 credits, (2) adding an honours research
opportunity with MATH 498-1 and MATH 499W-5, and (3) replacing the PHYS 211
and CMPT 225 requirements with a wider selection of appropriate choices, are
aimed at making the degree stronger, more accessible, and attractive. MATH
498-1 and 499W-5 provide students with a research opportunity. They will also
help us build an honours cohort which was recommended to us by the
departmental external review committee in 2014.

Motion IV:
To change the lower division requirements for the Applied Mathematics Major Program

From (Lower Division Requirements for the Applied Mathematics Major Program):

Program Requirements

Students complete 120 units, as specified below.

Lower Division Requirements

Students complete all the following:

Including either one of

CMPT 126 - Introduction to Computing Science and Programming (3)
CMPT 128 - Introduction to Computing Science and Programming for Engineers (3)

or both of

CMPT 120 - Introduction to Computing Science and Programming I (3)
CMPT 125 - Introduction to Computing Science and Programming II (3)

or both of

CMPT 130 - Introduction to Computer Programming I (3)
CMPT 135 - Introduction to Computer Programming II (3)

and all of

MACM 203 - Computing with Linear Algebra (2) +
MACM 204 - Computing with Calculus (2) +
MATH 242 - Introduction to Analysis I (3)
MATH 251 - Calculus III (3)
MATH 252 - Vector Calculus (3)
PHYS 211 - Intermediate Mechanics (3)
STAT 270 - Introduction to Probability and Statistics (3)

and one of

MATH 150 - Calculus I with Review (4)

MATH 151 - Calculus I (3)
MATH 154 - Calculus I for the Biological Sciences (3) **
MATH 157 - Calculus I for the Social Sciences (3) **

and one of

MATH 152 - Calculus II (3) *
MATH 155 - Calculus II for the Biological Sciences (3) **
MATH 158 - Calculus II for the Social Sciences (3) **

and one of

MATH 232 - Applied Linear Algebra (3) **
MATH 240 - Algebra I: Linear Algebra (3)

and one of

PHYS 120 - Mechanics and Modern Physics (3)
PHYS 125 - Mechanics and Special Relativity (3)
PHYS 140 - Studio Physics - Mechanics and Modern Physics (4)

and one of

PHYS 121 - Optics, Electricity and Magnetism (3)
PHYS 126 - Electricity, Magnetism and Light (3)
PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4)

+ The following substitutions are also permitted.

They may not also be used to satisfy the upper division requirements below.

MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3) for MACM 203.

MACM 401 - Introduction to Computer Algebra (3) for MACM 204.

MACM 442 - Cryptography (3) for MACM 204.

* strongly recommended

** with a B grade or better

<u>To (Lower Division Requirements for the Applied Mathematics Major Program):</u>

Program Requirements

Students complete 120 units, as specified below.

Lower Division Requirements

Students complete the following:

One of

CMPT 126 - Introduction to Computing Science and Programming (3)
CMPT 128 - Introduction to Computing Science and Programming for Engineers (3)

or both of

CMPT 120 - Introduction to Computing Science and Programming I (3)
CMPT 125 - Introduction to Computing Science and Programming II (3)

or both of

CMPT 130 - Introduction to Computer Programming I (3)
CMPT 135 - Introduction to Computer Programming II (3)

and all of

MACM 203 - Computing with Linear Algebra (2) +
MACM 204 - Computing with Calculus (2) +
MATH 242 - Introduction to Analysis I (3)
MATH 251 - Calculus III (3)
MATH 252 - Vector Calculus (3)
PHYS 211 - Intermediate Mechanics (3)
STAT 270 - Introduction to Probability and Statistics (3)

and one of

MATH 150 - Calculus I with Review (4)
MATH 151 - Calculus I (3)
MATH 154 - Calculus I for the Biological Sciences (3) **
MATH 157 - Calculus I for the Social Sciences (3) **

and one of

MATH 152 - Calculus II (3) *
MATH 155 - Calculus II for the Biological Sciences (3) **
MATH 158 - Calculus II for the Social Sciences (3) **

and one of

MATH 232 - Applied Linear Algebra (3) **
MATH 240 - Algebra I: Linear Algebra (3)

and one of

PHYS 120 - Mechanics and Modern Physics (3)
PHYS 125 - Mechanics and Special Relativity (3)
PHYS 140 - Studio Physics - Mechanics and Modern Physics (4)

and one of

PHYS 121 - Optics, Electricity and Magnetism (3)
PHYS 126 - Electricity, Magnetism and Light (3)
PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4)

and at least one of

CMPT 225 - Data Structures and Programming (3)
ENSC 220 - Electric Circuits I (3)
MACM 201 - Discrete Mathematics II (3)
PHIL 210 - Natural Deductive Logic (3)
PHYS 211 - Intermediate Mechanics (3)
STAT 285 - Intermediate Probability and Statistics (3)

+ The following substitutions are also permitted.

They may not also be used to satisfy the upper division requirements below.

MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3) for MACM 203.

MACM 401 - Introduction to Computer Algebra (3) for MACM 204.

MACM 442 - Cryptography (3) for MACM 204.

* strongly recommended

** with a B grade or better

Rationale: Applied mathematics has changed in the last 30 years. The new lower division elective gives students direction as to what courses outside of mathematics they should consider.

SFU

Erin Barley
Lecturer
Chair, DUCC
Dept Biological Sciences

Simon Fraser University
Department of Biological
Sciences
8888 University Drive,
Burnaby, BC, Canada
V5A 1S6

TEL: 778-782-4972
ebarley@sfu.ca

January 5, 2015

ATTENTION: Carl Lowenberger,
Associate Dean, Faculty of Science

COPY: Elizabeth Elle
Chair, Department of Biological Sciences

RE: Proposed changes to undergraduate program from Department of
Biological Sciences

1. **Motion**: To change the wording of the BISC minor requirement to "and
a minimum of 15 units, consisting of five upper division BISC courses
(including MASC courses), as approved by the department".

Rationale: The proposed change specifies that students must take a
minimum of 5 upper division BISC courses, for a minimum of 15 credits.
The original wording predates 4 and 5 credit upper division courses. It
assumed, but did not specify, that students would complete a minimum of 5
courses.

Calendar Change:
Deletions in ~~strikethrough~~, additions in **bold**.

Department of Biological Sciences | Faculty of Science
Simon Fraser University Calendar | Spring 2015
Biological Sciences Minor

Program Requirements
Students complete all of

BISC 101 - General Biology (4)
BISC 102 - General Biology (4)
and at least two of

BISC 202 - Genetics (3)
BISC 204 - Introduction to Ecology (3)
MBB 222 - Molecular Biology and Biochemistry (3)

MBB 231 - Cellular Biology and Biochemistry (3)
~~and any 15 upper division BISC units, or closely related subject areas~~
~~(including MASC courses), as approved by the department.~~
**and a minimum of 15 units, consisting of five upper division BISC
courses (including MASC courses), as approved by the department.**

Sincerely,

Erin Barley

SFU

EXISTING COURSE CHANGE FORM
1 OF 2 PAGES

COURSE SUBJECT	PHYS	NUMBER	140	TITLE	Studio Physics - Mechanics and Modern Physics

INSTRUCTIONS (OVERALL):

1. Using Microsoft Word draft changes using the following guideline. Paste in box below.
2. Rationale must be included. If more space is needed than provided below, please use the provided text box on page 2 of this document.
3. Indicate term = Fall, Spring, Summer

TYPE OF CHANGES RECOMMENDED

Please check appropriate revision(s):

☐ Course number ☐ Credit ☐ Title ☐ Description ☑ Prerequisite

WORDING/DESCRIPTION EDITS

4. Indicate deleted or changed text using ~~strikethrough~~.
5. Indicate added or new text using underline.
6. Equivalent courses: preclusion statement should read:
   a. Students with credit for x cannot take y for further credit.

A general calculus-based introduction to mechanics taught in an integrated lecture-laboratory environment. Topics include translational and rotational motion, momentum, energy, gravitation, and selected topics in modern physics. Students with credit for PHYS 125 or 120 or 101 may not take this course for further credit.

Prerequisite: BC Principles of Physics 12 <u>or PHYS 100</u> or equivalent, with a minimum grade of C-. Corequisite: MATH 150 or 151 or 154 must precede or be taken concurrently.

SAMPLE

POL 223 ~~Canadian~~ <u>American</u> Political Economy (3)

~~An introductory study of~~ <u>America's</u> ~~Canada's~~ political economy, stressing the interrelated nature of Canada's economic and political life. ~~The course~~ <u>F</u>ocuses on current economic problems and policies, taking into account the geographical, historical and political environments. Topics include the resource and industrial structures, research and development, the public sector, fiscal and monetary policy, the role of the state, trade and foreign ownership, energy, regional disparity, corporate concentration and the political economy of federalism.

~~This course is identical to CNS 280 and students cannot take both courses for credit.~~ <u>Students with credit for CNS 280 cannot take POL 223 for further credit.</u>

~~Recommended~~ <u>Pre-requisite:</u> POL 100 or 101W.

Breadth – Social Sciences.

RATIONALE

If more space is needed, please use the provided text box on page 2 of this document

PHYS 100 is the equivalent of BC Physics 12, but was not explicitly listed as a possible prerequisite.

EFFECTIVE TERM AND YEAR, FOR CHANGES

Fall, Spring, Summer and year

Fall 2015

COURSE SUBJECT PHYS   **NUMBER** 141   **TITLE** Studio Physics - Optics, Electricity and Magnetism

INSTRUCTIONS (OVERALL):
1. Using Microsoft Word draft changes using the following guideline. Paste in box below.
2. Rationale must be included. If more space is needed than provided below, please use the provided text box on page 2 of this document.
3. Indicate term = Fall, Spring, Summer

TYPE OF CHANGES RECOMMENDED
Please check appropriate revision(s):

☐ Course number   ☐ Credit   ☐ Title   ☐ Description   ● Prerequisite

WORDING/DESCRIPTION EDITS
4. Indicate deleted or changed text using ~~strikethrough~~.
5. Indicate added or new text using <u>underline</u>.
6. Equivalent courses: preclusion statement should read:
   a. Students with credit for x cannot take y for further credit.

PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4)

A general calculus-based introduction to electricity, magnetism and optics taught in an integrated lecture-laboratory environment. Topics include electricity, magnetism, simple circuits, optics and topics from applied physics. Students with credit for PHYS 126 or 121 or 102 may not take this course for further credit.

Prerequisite: <u>PHYS 120 or 125 or</u> PHYS 140, with a minimum of grade of C-. <u>(or PHYS 101 with a minimum grade of B)</u>. Corequisite: MATH 152 or 155 must precede or be taken concurrently.

SAMPLE

POL 223 ~~Canadian~~ <u>American</u> Political Economy (3)

~~An introductory study of~~ <u>America's</u> ~~Canada's~~ political economy, stressing the interrelated nature of Canada's economic and political life. ~~The course~~ <u>F</u>ocuses on current economic problems and policies, taking into account the geographical, historical and political environments. Topics include the resource and industrial structures, research and development, the public sector, fiscal and monetary policy, the role of the state, trade and foreign ownership, energy, regional disparity, corporate concentration and the political economy of federalism.

~~This course is identical to CNS 280 and students cannot take both courses for credit.~~
<u>Students with credit for CNS 280 cannot take POL 223 for further credit.</u>

~~Recommended~~ <u>Pre-requisite:</u> POL 100 or 101W.

Breadth – Social Sciences.

RATIONALE
If more space is needed, please use the provided text box on page 2 of this document

PHYS 140 is the Studio version of PHYS 121 and should mirror its prerequisites. PHYS 101 is a less challenging version (algebra-based) of introductory physics than PHYS 140 (calculus-based), and thus the grade required to switch streams after the first term is higher than C-.

EFFECTIVE TERM AND YEAR, FOR CHANGES
Fall, Spring, Summer and year

Fall 2015

SFU

COURSE SUBJECT PHYS   **NUMBER** 211   **TITLE** Intermediate Mechanics

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INSTRUCTIONS (OVERALL):
1. Using Microsoft Word draft changes using the following guideline. Paste in box below.
2. Rationale must be included. If more space is needed than provided below, please use the provided text box on page 2 of this document.
3. Indicate term = Fall, Spring, Summer

TYPE OF CHANGES RECOMMENDED
Please check appropriate revision(s):

☐ Course number   ☐ Credit   ☐ Title   ☐ Description   ● Prerequisite

WORDING/DESCRIPTION EDITS
4. Indicate deleted or changed text using ~~strikethrough~~.
5. Indicate added or new text using underline.
6. Equivalent courses: preclusion statement should read:
   a. Students with credit for x cannot take y for further credit.

PHYS 211 - Intermediate Mechanics (3)

An intermediate mechanics course covering kinematics, dynamics, calculus of variations and Lagrange's equations, non-inertial reference frames, central forces and orbits, and rigid body motion.

Prerequisite: PHYS 126 or 121 or 141, with a minimum of grade of C-~~.~~ (or PHYS 102 with a minimum grade of B). Corequisite: MATH 251 and (MATH 232 or 240). Recommended: MATH 310 and PHYS 255

SAMPLE

POL 223 ~~Canadian~~ American Political Economy (3)

~~An introductory study of~~ America's ~~Canada's~~ political economy, stressing the interrelated nature of Canada's economic and political life. ~~The course~~ Focuses on current economic problems and policies, taking into account the geographical, historical and political environments. Topics include the resource and industrial structures, research and development, the public sector, fiscal and monetary policy, the role of the state, trade and foreign ownership, energy, regional disparity, corporate concentration and the political economy of federalism.

~~This course is identical to CNS 280 and students cannot take both courses for credit.~~
Students with credit for CNS 280 cannot take POL 223 for further credit.

~~Recommended~~ Pre-requisite: POL 100 or 101W.

Breadth – Social Sciences.

RATIONALE
If more space is needed, please use the provided text box on page 2 of this document

Students need a path from the introductory Physics courses for the life sciences into the 200-level Physics major courses, particularly for those students entering the Biophysics major stream. PHYS 102 is a less challenging version (algebra-based) of introductory physics than PHYS 121/126/141 (calculus-based), and thus the grade required to switch streams is higher than C-.

EFFECTIVE TERM AND YEAR, FOR CHANGES
Fall, Spring, Summer and year

Fall 2015

COURSE SUBJECT PHYS | **NUMBER** 321 | **TITLE** Intermediate Electricity and Magnetism

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INSTRUCTIONS (OVERALL):

1. Using Microsoft Word draft changes using the following guideline. Paste in box below.
2. Rationale must be included. If more space is needed than provided below, please use the provided text box on page 2 of this document.
3. Indicate term = Fall, Spring, Summer

TYPE OF CHANGES RECOMMENDED

Please check appropriate revision(s):

☐ Course number ☐ Credit ☐ Title ☐ Description ● Prerequisite

WORDING/DESCRIPTION EDITS

4. Indicate deleted or changed text using ~~strikethrough~~.
5. Indicate added or new text using <u>underline</u>.
6. Equivalent courses: preclusion statement should read:
   a. Students with credit for x cannot take y for further credit.

PHYS 321 - Intermediate Electricity and Magnetism (3)

Development and application of Maxwell's equations in vector differential form. Notation and theorems of vector calculus; electric charge, fields, potentials, capacitance and field energy; conductors; methods for solving electrostatic problems; electric fields in matter; electrical current and the magnetic field; Ampere's law and the vector potential; magnetic fields in matter; electromotive force, electrical resistance, Faraday's law and inductance; Maxwell's correction to Ampere's law and electromagnetic waves. Students with credit for PHYS 221 may not take this course for further credit.

Prerequisite: ~~PHYS 130 or 131 or 141~~ <u>PHYS 121 or 126 or 141 (or PHYS 102 with a minimum grade of B)</u>; MATH 252 or 254 and MATH 310, with a minimum grade of C-.

SAMPLE

POL 223 ~~Canadian~~ <u>American</u> Political Economy (3)

~~An introductory study of~~ <u>America's</u> ~~Canada's~~ political economy, stressing the interrelated nature of Canada's economic and political life. ~~The course~~ <u>F</u>ocuses on current economic problems and policies, taking into account the geographical, historical and political environments. Topics include the resource and industrial structures, research and development, the public sector, fiscal and monetary policy, the role of the state, trade and foreign ownership, energy, regional disparity, corporate concentration and the political economy of federalism.

~~This course is identical to CNS 280 and students cannot take both courses for credit.~~
<u>Students with credit for CNS 280 cannot take POL 223 for further credit.</u>

~~Recommended~~ <u>Pre-requisite:</u> POL 100 or 101W.

Breadth – Social Sciences.

RATIONALE

If more space is needed, please use the provided text box on page 2 of this document

Engineering has dropped the PHYS 131 lab from their required courses, but they still require PHYS 321 for ENSC degree completion. The prerequisite has been changed to the lecture courses that accompany the lab.

EFFECTIVE TERM AND YEAR, FOR CHANGES

Fall, Spring, Summer and year

Fall 2015

SFU

COURSE SUBJECT PHYS   **NUMBER** 231   **TITLE** Physics Laboratory II

INSTRUCTIONS (OVERALL):

1. Using Microsoft Word draft changes using the following guideline. Paste in box below.
2. Rationale must be included. If more space is needed than provided below, please use the provided text box on page 2 of this document.
3. Indicate term = Fall, Spring, Summer

TYPE OF CHANGES RECOMMENDED

Please check appropriate revision(s):

☐ Course number   ☐ Credit   ● Title   ● Description   ● Prerequisite

WORDING/DESCRIPTION EDITS

4. Indicate deleted or changed text using ~~strikethrough~~.
5. Indicate added or new text using underline.
6. Equivalent courses: preclusion statement should read:
   a. Students with credit for x cannot take y for further credit.

PHYS 231 - Physics Laboratory ~~II~~ III (3)

Introductory physics laboratory with experiments chosen from mechanics, heat, optics, electricity, magnetism, properties of matter, atomic and nuclear physics, along with lectures on the use of computers for data acquisition and data analysis in the physics laboratory. ~~Students with credit for PHYS 234 may not take this course for further credit.~~

Prerequisite: <u>PHYS 133 or</u> PHYS 141 or 131 or 130, with a minimum grade of C-. Recommended co-requisite: PHYS 255.

SAMPLE

POL 223 ~~Canadian~~ American Political Economy (3)

~~An introductory study of~~ America's ~~Canada's~~ political economy, stressing the interrelated nature of Canada's economic and political life. ~~The course~~ Focuses on current economic problems and policies, taking into account the geographical, historical and political environments. Topics include the resource and industrial structures, research and development, the public sector, fiscal and monetary policy, the role of the state, trade and foreign ownership, energy, regional disparity, corporate concentration and the political economy of federalism.

~~This course is identical to CNS 280 and students cannot take both courses for credit.~~
<u>Students with credit for CNS 280 cannot take POL 223 for further credit.</u>

~~Recommended~~ <u>Pre-requisite:</u> POL 100 or 101W.

Breadth – Social Sciences.

RATIONALE

If more space is needed, please use the provided text box on page 2 of this document

These changes should take effect Fall 2016, but this choice isn't available from the pull-down menu below.
Renaming: With the introduction of new lab courses PHYS 132 & 133, this course is now third in a four-course sequence of labs (PHYS 132, 133, 231, 233).
Description: PHYS 234 is no longer taught and has not been taught in over a decade.
Prerequisite: The new laboratory courses, PHYS 132, directly precedes PHYS 231 in the lab sequence.

EFFECTIVE TERM AND YEAR, FOR CHANGES

Fall, Spring, Summer and year

Summer 2016

SFU

COURSE SUBJECT PHYS **NUMBER** 233 **TITLE** Physics Laboratory III

INSTRUCTIONS (OVERALL):

1. Using Microsoft Word draft changes using the following guideline. Paste in box below.
2. Rationale must be included. If more space is needed than provided below, please use the provided text box on page 2 of this document.
3. Indicate term = Fall, Spring, Summer

TYPE OF CHANGES RECOMMENDED

Please check appropriate revision(s):

☐ Course number ☐ Credit ● Title ☐ Description ● Prerequisite

WORDING/DESCRIPTION EDITS

4. Indicate deleted or changed text using ~~strikethrough~~.
5. Indicate added or new text using <u>underline</u>.
6. Equivalent courses: preclusion statement should read:
   a. Students with credit for x cannot take y for further credit.

PHYS 233 - Physics Laboratory ~~III~~ <u>IV</u> (2)

Experiments chosen from among mechanics, heat, optics, electricity, magnetism, properties of matter, atomic and nuclear physics. Engineering Science students will do a selected set of experiments.

Prerequisite: PHYS 231 or ENSC 220, with a minimum grade of C-.

SAMPLE

POL 223 ~~Canadian~~ American Political Economy (3)

~~An introductory study of~~ America's ~~Canada's~~ political economy, stressing the interrelated nature of Canada's economic and political life. ~~The course~~ <u>F</u>ocuses on current economic problems and policies, taking into account the geographical, historical and political environments. Topics include the resource and industrial structures, research and development, the public sector, fiscal and monetary policy, the role of the state, trade and foreign ownership, energy, regional disparity, corporate concentration and the political economy of federalism.

~~This course is identical to CNS 280 and students cannot take both courses for credit.~~
<u>Students with credit for CNS 280 cannot take POL 223 for further credit.</u>

~~Recommended~~ <u>Pre-requisite</u>: POL 100 or 101W.

Breadth – Social Sciences.

RATIONALE

If more space is needed, please use the provided text box on page 2 of this document

This change should go into effect in Fall 2016, but this is not an option on the pull-down menu below.
This course is now fourth in a four-course sequence of labs comprised of PHYS 132 (new), 133 (new), and 231. The prerequisite was simplified to remove a grade requirement that is implicit.

EFFECTIVE TERM AND YEAR, FOR CHANGES

Fall, Spring, Summer and year

Summer 2016

COURSE SUBJECT PHYS   **NUMBER** 132

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

Physics Laboratory I

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

Physics Laboratory I

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

COURSE DESCRIPTION (FOR CALENDAR). 50 WORDS MAXIMUM. ATTACH A COURSE OUTLINE TO THIS PROPOSAL

Introduction to experimental physics with an emphasis on measurement and experimental design. Includes elementary experiments in mechanics designed to support and enrich conceptual learning. Students with credit for PHYS 130, 131, or 140 may not take PHYS 132 for further credit.

REPEAT FOR CREDIT ☐ YES ☑ NO   How many times? [ ]   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 a library report and, if appropriate, confirmation that funding arrangements have been addressed.

Library report status, see lib.sfu.ca/collections/course-assessments | No library materials required.

RATIONALE FOR INTRODUCTION OF THIS COURSE
If more space is needed, please use the provided text box on page 4 of this document

PHYS 132-1 and PHYS 133-1 form a sequence of two 1-credit lab courses that support the introductory lecture courses PHYS 120 and PHYS 121 respectively, as well as PHYS 125 and PHYS 126 respectively. PHYS 132-1 and PHYS 133-1 replace the existing PHYS 131-2 laboratory (2 credits).

The current PHYS 131 lab course suffers from a lack of synchronization with the lecture courses, resulting in students often not having enough prior knowledge to understand fully all lab activities. Splitting the existing lab course into two semesters will allow better synchronization with the lecture material. Shorter labs spread over a longer time also will enable better scaffolding of experimental laboratory skills through more focused lab experiments and repetition over the two-semester sequence.

This two-semester lab sequence was previously not possible, due to space constraints in the Physics labs. New renovations make better use of space and now permit the multiple offerings necessary to support a two-semester lab sequence.

SCHEDULING AND ENROLLMENT INFORMATION
Term and year course would first be offered (e.g. FALL 2014) and planned **frequency** (e.g. each semester) of offering thereafter:

FALL 2015, to be offered twice annually.

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

What is the probable enrollment when offered?   Estimate: 120

UNITS

Indicate number of units: | 1

Indicate no. of contact hours for: | 0 | Lecture | 0 | Seminar | 0 | Tutorial | 3 | Lab | | Other – please explain

OTHER

PHYS 132 consists of 8 3-hour labs.

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

All CFL are qualified to teach this introductory course.

WQB DESIGNATION (attach approval from Curriculum Office)

Quantitative

PREREQUISITE AND / OR COREQUISITE

Corequisite: PHYS 120 or 125.

EQUIVALENT COURSES

Does this course replicate the content of a previously-approved course to such an extent that students should not receive credit for both courses?

Students with credit for PHYS 130, 131, or 140 may not take PHYS 132 for further credit.

COURSE – LEVEL EDUCATIONAL GOALS (OPTIONAL)

FEES

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

RESOURCES

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

PHYS 132 will be housed in the newly renovated Physics laboratory. Laboratory equipment is funded by the University Priority Fund.

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

Jeffrey McGuirk, Undergraduate Committee Chair, Dept. of Physics

COURSE SUBJECT PHYS   **NUMBER** 133

COURSE TITLE

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

Physics Laboratory II

AND

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

Physics Laboratory II

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

COURSE DESCRIPTION (FOR CALENDAR). 50 WORDS MAXIMUM. ATTACH A COURSE OUTLINE TO THIS PROPOSAL

Introduction to experimental physics with an emphasis on measurement and experimental design. Includes elementary experiments in electromagnetism and optics designed to support and enrich conceptual learning. Students with credit for PHYS 130, 131, or 141 may not take PHYS 133 for further credit. Prerequisite: PHYS 132 or ENSC 120. Corequisite: PHYS 121 or 126. Quantitative.

REPEAT FOR CREDIT ☐ YES ☑ NO   How many times? ☐   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 a library report and, if appropriate, confirmation that funding arrangements have been addressed.

Library report status, see lib.sfu.ca/collections/course-assessments | No library materials required.

RATIONALE FOR INTRODUCTION OF THIS COURSE

If more space is needed, please use the provided text box on page 4 of this document

PHYS 132-1 and PHYS 133-1 form a sequence of two 1-credit lab courses that support the introductory lecture courses PHYS 120 and PHYS 121 respectively, as well as PHYS 125 and PHYS 126 respectively. PHYS 132-1 and PHYS 133-1 replace the existing PHYS 131-2 laboratory (2 credits).

The current PHYS 131 lab course suffers from a lack of synchronization with the lecture courses, resulting in students often not having enough prior knowledge to understand fully all lab activities. Splitting the existing lab course into two semesters will allow better synchronization with the lecture material. Shorter labs spread over a longer time also will enable better scaffolding of experimental laboratory skills through more focused lab experiments and repetition over the two-semester sequence.

This two-semester lab sequence was previously not possible, due to space constraints in the Physics labs. New renovations make better use of space and now permit the multiple offerings necessary to support a two-semester lab sequence.

SCHEDULING AND ENROLLMENT INFORMATION

Term and year course would first be offered (e.g. FALL 2014) and planned **frequency** (e.g. each semester) of offering thereafter:

SPRING 2016, to be offered twice annually.

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

What is the probable enrollment when offered?   Estimate: 120

UNITS

Indicate number of units: 1

Indicate no. of contact hours for: 0 Lecture 0 Seminar 0 Tutorial 3 Lab ☐ Other – please explain

OTHER

PHYS 133 consists of 8 3-hour labs.

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

All CFL are qualified to teach this introductory course.

WQB DESIGNATION   (attach approval from Curriculum Office)

Quantitative

PREREQUISITE AND / OR COREQUISITE

Prerequisite: PHYS 132 or ENSC 120. Corequisite: PHYS 121 or 126.

EQUIVALENT COURSES

Does this course replicate the content of a previously-approved course to such an extent that students should not receive credit for both courses?

Students with credit for PHYS 130 or 131 or 141 may not take PHYS 133 for further credit.

COURSE – LEVEL EDUCATIONAL GOALS (OPTIONAL)

FEES

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

RESOURCES

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

PHYS 132 will be housed in the newly renovated Physics laboratory. Laboratory equipment is funded by the University Priority Fund.

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

Jeffrey McGuirk, Undergraduate Committee Chair, Dept. of Physics

MEMORANDUM

ATTENTION Carl Loenberger, Associate Dean, Faculty   **DATE**   January 14, 2015
of Science

FROM Susan Rhodes, Director   **PAGES** 1
University Curriculum & Institutional Liaison

RE: PHYS Q designation approvals

The University Curriculum Office has approved **Q** designations for the following new Faculty of Science courses, effective Fall 2015 (1157):

PHYS 132-1 Physics Laboratory I
PHYS 133-1 Physics Laboratory II

cc: Jeff McGuirk, Physics Undergraduate Chair

Applied Physics Program Lower Division Requirements

Students complete a minimum total of 54 units, including all of
    CHEM 121 - General Chemistry and Laboratory I (4)
    CHEM 122 - General Chemistry II (2)
    CHEM 126 - General Chemistry Laboratory II (2)
    CMPT 102 - Introduction to Scientific Computer Programming (3)
    CMPT 150 - Introduction to Computer Design (3)
    CMPT 250 - Introduction to Computer Architecture (3)
    MATH 152 - Calculus II (3)
    MATH 251 - Calculus III (3)
    MATH 252 - Vector Calculus (3)
    ~~PHYS 131 - Physics Laboratory I (2) *~~
    PHYS 132 – Physics Laboratory I (1) *
    PHYS 133 – Physics Laboratory II (1) *
    PHYS 211 - Intermediate Mechanics (3)
    PHYS 231 - Physics Laboratory III (3)
    PHYS 233 - Physics Laboratory IV (2)
    PHYS 255 - Vibrations and Waves (3)
    PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)

and one of
    MATH 150 - Calculus I with Review (4)
    MATH 151 - Calculus I (3)

and one of
    MATH 232 - Applied Linear Algebra (3)
    MATH 240 - Algebra I: Linear Algebra (3)

and one of
    PHYS 120 - Mechanics and Modern Physics (3)
    PHYS 125 - Mechanics and Special Relativity (3) +
    PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
    PHYS 121 - Optics, Electricity and Magnetism (3)
    PHYS 126 - Electricity, Magnetism and Light (3) +
    PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended

Applied Physics Honours Program Lower Division Requirements

Students complete a minimum total of 54 units, including all of
    CHEM 121 - General Chemistry and Laboratory I (4)
    CHEM 122 - General Chemistry II (2)
    CHEM 126 - General Chemistry Laboratory II (2)
    CMPT 102 - Introduction to Scientific Computer Programming (3)
    CMPT 150 - Introduction to Computer Design (3)
    CMPT 250 - Introduction to Computer Architecture (3)
    MATH 251 - Calculus III (3)
    MATH 252 - Vector Calculus (3)
    ~~PHYS 131 - Physics Laboratory I (2) *~~
    PHYS 132 – Physics Laboratory I (1) *
    PHYS 133 – Physics Laboratory II (1) *
    PHYS 211 - Intermediate Mechanics (3)
    PHYS 231 - Physics Laboratory III (3)
    PHYS 233 - Physics Laboratory IV (2)
    PHYS 255 - Vibrations and Waves (3)
    PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)

and one of
    MATH 125 - Math methods for Phys.Sci.-I (3)
    MATH 150 - Calculus I with Review (4)
    MATH 151 - Calculus I (3)

and one of
    MATH 126 - Math methods for Phys.Sci.-II (3)
    MATH 152 - Calculus II (4)

and one of
    MATH 232 - Applied Linear Algebra (3)
    MATH 240 - Algebra I: Linear Algebra (3)

and one of
    PHYS 120 - Mechanics and Modern Physics (3)
    PHYS 125 - Mechanics and Special Relativity (3) +
    PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
    PHYS 121 - Optics, Electricity and Magnetism (3)
    PHYS 126 - Electricity, Magnetism and Light (3) +
    PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

An additional second year CMPT course, such as CMPT 212, is recommended.

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended

Biological Physics Program Lower Division Requirements

Students complete a minimum total of 64 units, including all of
    BISC 101 - General Biology (4)
    BISC 102 - General Biology (4)
    BISC 202 - Genetics (3)
    CHEM 121 - General Chemistry and Laboratory I (4)
    CHEM 122 - General Chemistry II (2)
    CHEM 281 - Organic Chemistry I (4)
    CHEM 282 - Organic Chemistry II (2)
    MATH 251 - Calculus III (3)
    MATH 252 - Vector Calculus (3)
    MBB 222 - Molecular Biology and Biochemistry (3)
    MBB 231 - Cellular Biology and Biochemistry (3)
    PHYS 211 - Intermediate Mechanics (3)
    PHYS 231 - Physics Laboratory II (3)
    PHYS 255 - Vibrations and Waves (3)

and one of
    MATH 125 - Math methods for Phys.Sci.-I (3)
    MATH 150 - Calculus I with Review (4)
    MATH 151 - Calculus I (3)

and one of
    MATH 126 - Math methods for Phys.Sci.-II (3)
    MATH 152 - Calculus II (4)

and one of
    MATH 232 - Applied Linear Algebra (3)
    MATH 240 - Algebra I: Linear Algebra (3)

and one of
    CHEM 260 - Atoms, Molecules, Spectroscopy (4)
    PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)

and one of
    PHYS 101 - Physics for the Life Sciences I (3)
    PHYS 120 - Mechanics and Modern Physics (3)
    PHYS 125 - Mechanics and Special Relativity (3) +
    PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
    PHYS 102 - Physics for the Life Sciences II (3)
    PHYS 121 - Optics, Electricity and Magnetism (3)
    PHYS 126 - Electricity, Magnetism and Light (3) +
    PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

~~and one of~~

and either
   PHYS 130 - Physics for the Life Sciences Laboratory (2)
   ~~PHYS 131 - Physics Laboratory I (2) *~~
or both of
   PHYS 132 – Physics Laboratory I (1)
   PHYS 133 – Physics Laboratory II (1)

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended

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Biological Physics Honours Program Lower Division Requirements

Students complete a minimum total of 64 units, including all of
   BISC 101 - General Biology (4)
   BISC 102 - General Biology (4)
   BISC 202 - Genetics (3)
   CHEM 121 - General Chemistry and Laboratory I (4)
   CHEM 122 - General Chemistry II (2)
   CHEM 281 - Organic Chemistry I (4)
   CHEM 282 - Organic Chemistry II (2)
   MATH 251 - Calculus III (3)
   MATH 252 - Vector Calculus (3)
   MBB 222 - Molecular Biology and Biochemistry (3)
   MBB 231 - Cellular Biology and Biochemistry (3)
   PHYS 211 - Intermediate Mechanics (3)
   PHYS 231 - Physics Laboratory III (3)
   PHYS 255 - Vibrations and Waves (3)

and one of
   MATH 125 - Math methods for Phys.Sci.-I (3)
   MATH 150 - Calculus I with Review (4)
   MATH 151 - Calculus I (3)

and one of
   MATH 126 - Math methods for Phys.Sci.-II (3)
   MATH 152 - Calculus II (4)

and one of
   MATH 232 - Applied Linear Algebra (3)
   MATH 240 - Algebra I: Linear Algebra (3)

and one of
   CHEM 260 - Atoms, Molecules, Spectroscopy (4)
   PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)

and one of
   PHYS 101 - Physics for the Life Sciences I (3)
   PHYS 120 - Mechanics and Modern Physics (3)
   PHYS 125 - Mechanics and Special Relativity (3) +
   PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
   PHYS 102 - Physics for the Life Sciences II (3)
   PHYS 121 - Optics, Electricity and Magnetism (3)
   PHYS 126 - Electricity, Magnetism and Light (3) +
   PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

~~and one of~~

and either
    PHYS 130 - Physics for the Life Sciences Laboratory (2)
    ~~PHYS 131 - Physics Laboratory I (2) *~~
or both of
    PHYS 132 – Physics Laboratory I (1)
    PHYS 133 – Physics Laboratory II (1)

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended

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Chemical Physics Program Lower Division Requirements

Students are strongly encouraged to complete at least three lower division computing science units, in addition to the following requirements.

Students complete a minimum total of 59 units, including all of
    CHEM 121 - General Chemistry and Laboratory I (4)
    CHEM 122 - General Chemistry II (2)
    CHEM 126 - General Chemistry Laboratory II (2)
    CHEM 215 - Introduction to Analytical Chemistry (4)
    CHEM 230 - Inorganic Chemistry (3)
    CHEM 236W - Inorganic Chemistry Laboratory (3)
    CHEM 266 - Physical Chemistry Laboratory I (2)
    CHEM 281 - Organic Chemistry I (4)
    MATH 251 - Calculus III (3)
    MATH 252 - Vector Calculus (3)
    ~~PHYS 131 - Physics Laboratory I (2) *~~
    PHYS 132 – Physics Laboratory I (1) *
    PHYS 133 – Physics Laboratory II (1) *
    PHYS 211 - Intermediate Mechanics (3)
    PHYS 231 - Physics Laboratory III (3)
    PHYS 255 - Vibrations and Waves (3)

and one of
    MATH 125 - Math methods for Phys.Sci.-I (3)
    MATH 150 - Calculus I with Review (4)
    MATH 151 - Calculus I (3)

and one of
    MATH 126 - Math methods for Phys.Sci.-II (3)
    MATH 152 - Calculus II (4)

and one of
    MATH 232 - Applied Linear Algebra (3)
    MATH 240 - Algebra I: Linear Algebra (3)

and one of
    CHEM 260 - Atoms, Molecules, Spectroscopy (4)
    PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)

and one of
    PHYS 120 - Mechanics and Modern Physics (3)
    PHYS 125 - Mechanics and Special Relativity (3) +
    PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
    PHYS 121 - Optics, Electricity and Magnetism (3)
    PHYS 126 - Electricity, Magnetism and Light (3) +

PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended

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Chemical Physics Honours Program Lower Division Requirements

Students are strongly encouraged to complete at least three lower division CMPT units, in addition to the following requirements.

Students complete a minimum total of 59 units, including all of
    CHEM 121 - General Chemistry and Laboratory I (4)
    CHEM 122 - General Chemistry II (2)
    CHEM 126 - General Chemistry Laboratory II (2)
    CHEM 215 - Introduction to Analytical Chemistry (4)
    CHEM 230 - Inorganic Chemistry (3)
    CHEM 236W - Inorganic Chemistry Laboratory (3)
    CHEM 266 - Physical Chemistry Laboratory I (2)
    CHEM 281 - Organic Chemistry I (4)
    MATH 251 - Calculus III (3)
    MATH 252 - Vector Calculus (3)
    ~~PHYS 131 - Physics Laboratory I (2) *~~
    PHYS 132 – Physics Laboratory I (1) *
    PHYS 133 – Physics Laboratory II (1) *
    PHYS 211 - Intermediate Mechanics (3)
    PHYS 231 - Physics Laboratory III (3)
    PHYS 255 - Vibrations and Waves (3)

and one of
    MATH 125 - Math methods for Phys.Sci.-I (3)
    MATH 150 - Calculus I with Review (4)
    MATH 151 - Calculus I (3)

and one of
    MATH 126 - Math methods for Phys.Sci.-II (3)
    MATH 152 - Calculus II (4)

and one of
    MATH 232 - Applied Linear Algebra (3)
    MATH 240 - Algebra I: Linear Algebra (3)

and one of
    CHEM 260 - Atoms, Molecules, Spectroscopy (4)
    PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)

and one of
    PHYS 120 - Mechanics and Modern Physics (3)
    PHYS 125 - Mechanics and Special Relativity (3) +
    PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
    PHYS 121 - Optics, Electricity and Magnetism (3)
    PHYS 126 - Electricity, Magnetism and Light (3) +

PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended

Mathematical Physics Honours Program Lower Division Requirements

Students complete a minimum total of 46 units, including all of
    MATH 242 - Introduction to Analysis I (3)
    MATH 251 - Calculus III (3)
    MATH 252 - Vector Calculus (3)
    ~~PHYS 131 - Physics Laboratory I (2) *~~
    PHYS 132 – Physics Laboratory I (1) *
    PHYS 133 – Physics Laboratory II (1) *
    PHYS 211 - Intermediate Mechanics (3)
    PHYS 231 - Physics Laboratory III(3)
    PHYS 233 - Physics Laboratory ıν́ (2)
    PHYS 255 - Vibrations and Waves (3)
    PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)
    STAT 270 - Introduction to Probability and Statistics (3)

and either both of
    CMPT 120 - Introduction to Computing Science and Programming I (3)
    CMPT 125 - Introduction to Computing Science and Programming II (3)

or one of
    CMPT 102 - Introduction to Scientific Computer Programming (3)
    CMPT 126 - Introduction to Computing Science and Programming (3)

and one of
    MATH 125 - Math methods for Phys.Sci.-I (3)
    MATH 150 - Calculus I with Review (4)
    MATH 151 - Calculus I (3)

and one of
    MATH 126 - Math methods for Phys.Sci.-II (3)
    MATH 152 - Calculus II (4)

and one of
    MATH 232 - Applied Linear Algebra (3)
    MATH 240 - Algebra I: Linear Algebra (3)

and one of
    PHYS 120 - Mechanics and Modern Physics (3)
    PHYS 125 - Mechanics and Special Relativity (3) +
    PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
    PHYS 121 - Optics, Electricity and Magnetism (3)
    PHYS 126 - Electricity, Magnetism and Light (3) +
    PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

It is recommended that students also complete CHEM 121 and 122.

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended

Physics Program Lower Division Requirements

Students complete a minimum total of 46 units, including all of
  CHEM 121 - General Chemistry and Laboratory I (4)
  CHEM 122 - General Chemistry II (2)
  CMPT 102 - Introduction to Scientific Computer Programming (3)
  MATH 251 - Calculus III (3)
  MATH 252 - Vector Calculus (3)
  ~~PHYS 131 - Physics Laboratory I (2) *~~
  PHYS 132 – Physics Laboratory I (1) *
  PHYS 133 – Physics Laboratory II (1) *
  PHYS 211 - Intermediate Mechanics (3)
  PHYS 231 - Physics Laboratory III (3)
  PHYS 233 - Physics Laboratory IV (2)
  PHYS 255 - Vibrations and Waves (3)
  PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)

and one of
  MATH 125 - Math methods for Phys.Sci.-I (3)
  MATH 150 - Calculus I with Review (4)
  MATH 151 - Calculus I (3)

and one of
  MATH 126 - Math methods for Phys.Sci.-II (3)
  MATH 152 - Calculus II (4)

and one of
  MATH 232 - Applied Linear Algebra (3)
  MATH 240 - Algebra I: Linear Algebra (3)

and one of
  PHYS 120 - Mechanics and Modern Physics (3)
  PHYS 125 - Mechanics and Special Relativity (3) +
  PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
  PHYS 121 - Optics, Electricity and Magnetism (3)
  PHYS 126 - Electricity, Magnetism and Light (3) +
  PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended

Physics Honours Program Lower Division Requirements

Students complete a minimum total of 46 units, including all of
    CHEM 121 - General Chemistry and Laboratory I (4)
    CHEM 122 - General Chemistry II (2)
    CMPT 102 - Introduction to Scientific Computer Programming (3)
    MATH 251 - Calculus III (3)
    MATH 252 - Vector Calculus (3)
    ~~PHYS 131 - Physics Laboratory I (2) *~~
    PHYS 132 – Physics Laboratory I (1) *
    PHYS 133 – Physics Laboratory II (1) *
    PHYS 211 - Intermediate Mechanics (3)
    PHYS 231 - Physics Laboratory III (3)
    PHYS 233 - Physics Laboratory IV (2)
    PHYS 255 - Vibrations and Waves (3)
    PHYS 285 - Introduction to Relativity and Quantum Mechanics (3)

and one of
    MATH 125 - Math methods for Phys.Sci.-I (3)
    MATH 150 - Calculus I with Review (4)
    MATH 151 - Calculus I (3)

and one of
    MATH 126 - Math methods for Phys.Sci.-II (3)
    MATH 152 - Calculus II (4)

and one of
    MATH 232 - Applied Linear Algebra (3)
    MATH 240 - Algebra I: Linear Algebra (3)

and one of
    PHYS 120 - Mechanics and Modern Physics (3)
    PHYS 125 - Mechanics and Special Relativity (3) +
    PHYS 140 - Studio Physics - Mechanics and Modern Physics (4) *

and one of
    PHYS 121 - Optics, Electricity and Magnetism (3)
    PHYS 126 - Electricity, Magnetism and Light (3) +
    PHYS 141 - Studio Physics - Optics, Electricity and Magnetism (4) *

~~* students with credit for PHYS 140 and 141 are not required to complete PHYS 131~~
* students with credit for PHYS 140 and 141 are not required to complete PHYS 132 or 133
+ recommended