S.13-59

SFU OFFICE OF THE ASSOCIATE VICE-PRESIDENT, ACADEMIC AND ASSOCIATE PROVOST

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MEMORANDUM

ATTENTION	Senate	**DATE**	March 8, 2013
FROM	Gordon Myers, Chair Senate Committee on Undergraduate Studies	**PAGES**	1
RE:	Faculty of Applied Sciences (SCUS 13-10)		

For information:

Acting under delegated authority at its meeting of March 7, 2013, SCUS approved the following curriculum revisions effective Fall 2013:

1. Geographic Information Science (GIS) (SCUS 13-10b)

   (i) Changes to the Lower Division requirements for the GIS Major Program
   (ii) Changes to the Lower Division requirements for the GIS Honours Program

2. School of Computing Science (SCUS 13-10c)

   (i) Requirement change to the Certificate in Computing Science
   (ii) Requirement change to the Internal Transfer Regulations (Computing Science Major and Honours, Software Systems, Computing Science and Linguistics Joint Major)
   (iii) Prerequisite change for CMPT 102, 126 and 379

3. Mechatronic Systems Engineering (SCUS 13-10d)

   (i) Credit number change for MSE 421, 451and 480
   (ii) New Course Proposals:
   MSE 420-4, Introduction to Biomechanical Engineering
   MSE 422-4, Fuel Cell Systems
   MSE 423-4, Energy Conversion
   MSE 424-4, Microfluidics
   MSE 425-4, Nano Manufacturing for Nano-scale Devices

   (iii) Requirement changes to the Mechatronic Systems Engineering Major and Honours Elective Courses

Geographic Information Science 2013-2014 Curriculum Revision

Faculty of Applied Sciences Curriculum Committee

Richard Vaughan and Robert D. Cameron
February 25, 2013

Introduction

The following program revisions are made to the GIS major and honours programs following corresponding changes to the CMPT major program.

1. Revisions to GIS Major program.
2. Revision to the GIS Honours program.

Revision to the GIS Major Program

The changes give students more options. First, CMPT 126 is listed as an acceptable alternative to CMPT 120 and CMPT 125, in accord to the normal treatment for CMPT majors. Second, MATH 240 is listed as an acceptable alternative to MATH 232, also in accord with the normal treatment for CMPT majors.

Current	Proposed
Lower Division Requirements Students complete a total of ~~42 or~~ 43 lower division units including all of ~~• CMPT 120 Introduction to Computing Science and Programming I (3)~~ ~~• CMPT 125 Introduction to Computing Science and Programming II (3)~~ • CMPT 225 Data Structures and Programming (3) • GEOG 100 Society, Space, Environment: Introducing Human Geography (3) • GEOG 111 Earth Systems (3) • GEOG 253 Introduction to Remote Sensing (3) • GEOG 255 Geographical Information Science I (3) • MACM 101 Discrete Mathematics I (3) • MACM 201 Discrete Mathematics II (3) ~~• MATH 232 Applied Linear Algebra (3)~~ and one of • GEOG 213 Introduction to	**Lower Division Requirements** Students complete a total of **39-**43 lower division units including all of • CMPT 225 Data Structures and Programming (3) • GEOG 100 Society, Space, Environment: Introducing Human Geography (3) • GEOG 111 Earth Systems (3) • GEOG 253 Introduction to Remote Sensing (3) • GEOG 255 Geographical Information Science I (3) • MACM 101 Discrete Mathematics I (3) • MACM 201 Discrete Mathematics II (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** • **CMPT 126 Introduction to Computing**

Current	Proposed
Geomorphology (3) • GEOG 214 Weather and Climate (3) • GEOG 215 Biogeography (3) • GEOG 221 Economic Geography (3) • GEOG 241 Social Geography (3) • GEOG 261 Introduction to Urban Geography (3) and one of • GEOG 251 Quantitative Geography (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) †with a grade of B+ or better and permission of the School of Computing Science	**Science and Programming (3)** and one of • GEOG 213 Introduction to Geomorphology (3) • GEOG 214 Weather and Climate (3) • GEOG 215 Biogeography (3) • GEOG 221 Economic Geography (3) • GEOG 241 Social Geography (3) • GEOG 261 Introduction to Urban Geography (3) and one of • GEOG 251 Quantitative Geography (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 1: Linear Algebra (3)** †with a grade of B+ or better and permission of the School of Computing Science

Changes to the GIS Honours Program

Corresponding changes to the GIS Honours program parallel those to the GIS major program as shown below.

Current	Proposed
Lower Division Requirements Students complete a total of ~~52~~-53 lower division units including all of • ~~CMPT 120 Introduction to Computing Science and Programming I (3)~~ • ~~CMPT 125 Introduction to Computing Science and Programming II (3)~~ • CMPT 150 Introduction to Computer Design (3) • CMPT 225 Data Structures and Programming (3) • CMPT 275 Software Engineering I (4) • GEOG 100 Society, Space, Environment: Introducing Human Geography (3) • GEOG 111 Earth Systems (3) • GEOG 253 Introduction to Remote Sensing (3) • GEOG 255 Geographical Information Science I (3) • MACM 101 Discrete Mathematics I (3) • MACM 201 Discrete Mathematics II (3) • ~~MATH 232 Applied Linear Algebra (3)~~ and one of • GEOG 213 Introduction to Geomorphology (3) • GEOG 214 Weather and Climate (3) • GEOG 215 Biogeography (3) and one of • GEOG 221 Economic Geography (3) • GEOG 241 Social Geography (3) • GEOG 261 Introduction to Urban Geography (3) and one of • GEOG 251 Quantitative Geography (3) • STAT 270 Introduction to Probability and	**Lower Division Requirements** Students complete a total of **49**-53 lower division units including all of • CMPT 150 Introduction to Computer Design (3) • CMPT 225 Data Structures and Programming (3) • CMPT 275 Software Engineering I (4) • GEOG 100 Society, Space, Environment: Introducing Human Geography (3) • GEOG 111 Earth Systems (3) • GEOG 253 Introduction to Remote Sensing (3) • GEOG 255 Geographical Information Science I (3) • MACM 101 Discrete Mathematics I (3) • MACM 201 Discrete Mathematics II (3) • MATH 232 Applied Linear Algebra (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** • **CMPT 126 Introduction to Computing Science and Programming (3)** and one of • GEOG 213 Introduction to Geomorphology (3) • GEOG 214 Weather and Climate (3) • GEOG 215 Biogeography (3) and one of • GEOG 221 Economic Geography (3) • GEOG 241 Social Geography (3) • GEOG 261 Introduction to Urban

Current	Proposed
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) † with a grade of B+ or better and permission of the School of Computing Science	Geography (3) and one of • GEOG 251 Quantitative Geography (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 1: Linear Algebra (3)** † with a grade of B+ or better and permission of the School of Computing Science

Computing Science 2013-2014 Curriculum Revision
Faculty of Applied Sciences Curriculum Committee

Richard Vaughan and Robert D. Cameron
February 25, 2013

Introduction

The following curriculum revisions are proposed for the School of Computing Science for the Fall 2013 calendar.

1. Course prerequisite changes: CMPT 102, 126, and 379. Forms are attached.
2. Revision to the Certificate in Computing Studies.
3. Revision to internal transfer regulations for the Computing Science major.
4. Suspension of Admissions – Multimedia Computing Specialist Major. Document attached.
5. Suspension of Admissions – Software Engineering Specialist Major. Document attached.

Revision to the Certificate in Computing Studies

The certicate is indended for non-CS majors. An exclusion statement is added to enforce this restriction. Without this exclusion, all CS majors are qualified for the certicate before graduation, and some have exploited this to gain a redundant qualification.

Current	Proposed
This program provides both part-time and full-time students with an opportunity to understand the fundamentals of computers and programming without necessarily specializing in computing science.	This program provides both part-time and full-time students with an opportunity to understand the fundamentals of computers and programming without necessarily specializing in computing science. **Current SFU Computing Science students in Major or Honours programs (or related joint programs) may not apply to this program.**

Revision to Internal Transfer Regulations

The following following courses are added as eligible courses for transfer into a Burnaby or Surrey CMPT program. (1) CMPT 130-3, CMPT 135-3, CMPT 276-3; and (2) ENSC 250-3. Rationale in each case: (1) These are recently created courses and this change should have been made when they were created. They are versions of CMPT 120, 125 and 275 respectively, adapted for the Software Systems program. (2) ENSC 250 is equivalent to CMPT 250.

These changes are made to the internal transfer regulations (listed under Admission Requirements) of each of the following programs.

1. Computing Science Major
2. Software Systems Major
3. Computing Science Honours
4. Computing Science and Linguistics Joint Major

Current	Proposed
Internal Transfer Internal transfer allows students to transfer, within Simon Fraser University, from one faculty to another. Once students have completed the three qualifying courses, they can apply for internal transfer into the School of Computing Science. Simon Fraser University students applying for School of Computing Science admission are selected on the basis of an admission computing-related grade point average (CRGPA). The CRGPA is calculated over the best three courses chosen as follows. • one mathematics course chosen from MACM 101, 201, MATH 150 (or 151), 152 and 240 (or 232) • one computing course chosen from CMPT 125 (or 126 or 128), 150, (or ENSC 150), 225, 250 and 275 • one additional mathematics or computing science course chosen from the above lists No course may be included in the average if it is a duplicate of any previous course completed at Simon Fraser University or elsewhere. All three courses must be completed prior to application. For complete information, contact an Applied Sciences Advisor.	**Internal Transfer** Internal transfer allows students to transfer, within Simon Fraser University, from one faculty to another. Once students have completed the three qualifying courses, they can apply for internal transfer into the School of Computing Science. Simon Fraser University students applying for School of Computing Science admission are selected on the basis of an admission computing-related grade point average (CRGPA). The CRGPA is calculated over the best three courses chosen as follows. • one mathematics course chosen from MACM 101, 201, MATH 150 (or 151), 152 and 240 (or 232) • one computing course chosen from CMPT 125 (or 126, **128, 130 or 135**), 150, (or ENSC 150), 225, 250 **(or ENSC 250)** and 275 **(or 276)**. • one additional mathematics or computing science course chosen from the above lists No course may be included in the average if it is a duplicate of any previous course completed at Simon Fraser University or elsewhere. All three courses must be completed prior to application. For complete information, contact an Applied Sciences Advisor.

Suspension of Admission – Multimedia Computing Specialist Major

The entire calendar entry for this major is to be replaced with the following statement: "Normal admission to the Multimedia Computing Specialist Major has been suspended effective September 1, 2013. Admission appeals will be considered until December 31, 2013. Students are still able to take the same classes, but no special certification will be available."

Suspension of Admission – Software Engineering Specialist Major

The entire calendar entry for this major is to be replaced with the following statement: "Normal admission to the Software Engineering Specialist Major has been suspended effective September 1, 2013. Admission appeals will be considered until December 31, 2013. Students interested in software engineering are urged to consider the more modern Software Systems Major offering a comprehensive systems and software engineering curriculum. "

SFU

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 _____ Seminar _____ Tutorial _____ Lab _____

FROM
Course Subject/Number CMPT 102

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:

(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: Students with credit for CMPT 120, 126 or 128 may not take CMPT 102 for further credit.

PREREQUISITE

TO: Students with credit for CMPT 120, 125, 126, 130, 135, or 128 may not take CMPT 102 for further credit.

LEARNING OUTCOMES

RATIONALE

CMPT 102 is an introductory CS class and should not be taken after another intro class. CMPT 125 was missing from this list by mistake. CMPT 130 and 135 are new classes and should have been added here on creation.

Effective term and year September 2013

SFU

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 _____ Seminar _____ Tutorial _____ Lab _____

FROM
Course Subject/Number CMPT 126

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:

(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: BC Math 12 (or equivalent, or any of MATH 100, 150, 151, 154, or 157). Students with credit for CMPT 125, 128, 130 or CMPT 200 or higher may not take for further credit.

PREREQUISITE

TO: BC Math 12 (or equivalent, or any of MATH 100, 150, 151, 154, or 157). Students with credit for CMPT 120, 125, 128, 130, 135 or higher may not take for further credit.

LEARNING OUTCOMES

RATIONALE

CMPT126 carries B-Sci credits. This change prevents students from obtaining two B-Sci credits by taking CMPT 120 or 130 followed by CMPT 126: to continue with CS classes they must enroll in 125 or 135 which do not carry B-Sci credits.

Effective term and year September 2013

SFU

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 _____ Seminar _____ Tutorial _____ Lab _____

FROM
Course Subject/Number CMPT 379

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:

(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: Prerequisite: MACM 201, CMPT 150 and 225.

PREREQUISITE

TO: Prerequisites: MACM 201, (CMPT 150 or ENSC215) and CMPT 225.

LEARNING OUTCOMES

RATIONALE

ENSC215 covers the assembly language programming for the CMPT 379 Compilers class.

Effective term and year September 2013

Mechatronic Systems Engineering 2013-2014 Curriculum

Faculty of Applied Sciences Curriculum Committee

Ahmad Rad and Robert D. Cameron
February 25, 2013

Introduction

The School of Mechatronic Systems Engineering will be officially established on April 1, 2013 taking on responsibility for the existing Mechatronic Systems Engineering Major and Honours programs as well as responsibility (jointly with Beedie School of Business) for the existing Mechatronic Systems Engineering and Business Double Degree Program. As the standard mnemonic for the School, the MSE label has been introduced for all Mechatronic Systems Engineering courses, effective for the May 2013 calendar. To minimize the complexity of that process, only minimal curriculum content changes were approved at that time. The following proposals complete the revisions to Mechatronic Systems Engineering curriculum for Fall 2013.

1. Course credit change for MSE 421, 451, 480
   The course change forms are attached.
2. New course proposals:
   a) MSE 420-4 Introduction to Biomechanical Engineering
   b) MSE 422-4 Fuel Cell Systems
   c) MSE 423-4 Energy Conversion
   d) MSE 424-4 Microfluidics
   e) MSE 425-4 Nano Manufacturing for Nano-scale Devices

   The new course proposals and outlines are attached. A course conflict review for MSE 420 by the School of Biomedical Physiology and Kinesiology is also attached.
3. Revisions to the MSE Major and Honours programs, as documented below.

Changes to the Calendar Text for the Mechatronic Systems Engineering Major

This change updates the calendar text to emphasize MSE courses within the engineering elective requirements of the MSE Major, while continuing to allow relevant ENSC electives.

Current	Proposed
Engineering ~~Science~~ Elective Courses Students must also complete four engineering science elective courses selected from a pre-approved ENSC electives ~~list~~ that is available at http://mse.ensc.sfu.ca/undergraduate-students/academic-programs/4-year-ugrad-curriculum.html. With undergraduate curriculum committee chair permission, students may replace one engineering ~~science~~ elective with either a directed study or a special project laboratory course. Special topics courses that have been approved by the undergraduate curriculum committee chair and the director may be counted here.	**Engineering Elective Courses** Students must also complete four engineering elective courses selected from a **list of** pre-approved **MSE and** ENSC electives that is available at http://mse.ensc.sfu.ca/undergraduate-students/academic-programs/4-year-ugrad-curriculum.html. With undergraduate curriculum committee chair permission, students may replace one engineering elective with either a directed study or a special project laboratory course. Special topics courses that have been approved by the undergraduate curriculum committee chair and the director may be counted here.

Changes to the Calendar Text for Mechatronic Systems Engineering Honours

This change updates the calendar text to emphasize MSE courses within the engineering elective requirements of the MSE Major, while continuing to allow relevant ENSC electives.

Current	Proposed
Engineering ~~Science~~ Elective Courses Students must also complete four engineering science elective courses selected from a pre-approved ENSC electives ~~list~~ that is available at http://mse.ensc.sfu.ca/undergraduate-students/academic-programs/4-year-ugrad-curriculum.html. With undergraduate curriculum committee chair permission, students may replace one engineering ~~science~~ elective with either a directed study or a special project laboratory course. Special topics courses that have been approved by the undergraduate curriculum committee chair and the director may be counted here.	**Engineering Elective Courses** Students must also complete four engineering elective courses selected from a **list of** pre-approved **MSE and** ENSC electives that is available at http://mse.ensc.sfu.ca/undergraduate-students/academic-programs/4-year-ugrad-curriculum.html. With undergraduate curriculum committee chair permission, students may replace one engineering elective with either a directed study or a special project laboratory course. Special topics courses that have been approved by the undergraduate curriculum committee chair and the director may be counted here.

SFU

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 _____ Seminar _____ Tutorial _____ Lab _____

FROM
Course Subject/Number MSE 421

TO
Course Subject/Number _____

Credits 3

Credits 4

TITLE

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

FROM:

Advanced Vibration

TO:

(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:

PREREQUISITE

TO:

LEARNING OUTCOMES

RATIONALE

This course was originally approved as ENSC 436-3 and subsequently relabelled MSE 421-3. When introduced the course was created with the 3-0-1-1 vector as above, with the intention that it be a 4-credit course. However, preparation of the paperwork mistakenly used only the lectures-hours in setting the course credit value.

Effective term and year September 2013

SFU

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 _____ Seminar _____ Tutorial _____ Lab _____

FROM
Course Subject/Number MSE 451

Credits 3

TO
Course Subject/Number _____

Credits 4

TITLE

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

FROM:

Advanced Electronic Circuits

TO:

(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:

PREREQUISITE

TO:

LEARNING OUTCOMES

RATIONALE

This course was originally approved as ENSC 430-3 and subsequently relabelled MSE 451-3. When introduced, the course was created with the 3-0-1-1 vector in the outline, with the intention that it be a 4-credit course. However, preparation of the paperwork mistakenly used only the lecture-hours in setting the course credit value.

Effective term and year September 2013

SFU

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 _____ Seminar _____ Tutorial _____ Lab _____

FROM
Course Subject/Number MSE 480

Credits 3

TO
Course Subject/Number _____

Credits 4

TITLE

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

FROM:

Manufacturing Systems

TO:

(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:

PREREQUISITE

TO:

LEARNING OUTCOMES

RATIONALE

This course was originally approved as ENSC 432-3 and subsequently relabelled MSE 480-3. When introduced, the course was created with the 3-0-1-1 vector in the outline, with the intention that it be a 4-credit course. However, preparation of the paperwork mistakenly used only the lecture-hours in setting the course credit value.

Effective term and year September 2013

COURSE SUBJECT/NUMBER

COURSE TITLE

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

MSE 420-4 Introduction to Biomechanical Engineering

AND

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

Biomech Eng

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.

Students apply mechanical theory to the study of biological systems and the human body, focusing on advanced mechanical theory, impact analysis and optimization methods with specific application to the study of human movement and injury. Medical device design, assessment, patenting and government regulation (FDA/Health Canada) are discussed.

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 will introduce a bio-focused fourth year engineering elective for students interested in biomechanics and biomedical device design.

SCHEDULING AND ENROLLMENT INFORMATION

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

Offered once a year in either Spring or Summer terms depending on MSE needs and faculty teaching load. Effective September 2013.

Will this be a required or elective course in the curriculum? ○ Required ◉ Elective

What is the probable enrollment when offered? Estimate: 25

CREDITS
Indicate number of credits (units): 4

Indicate number of hours for: Lecture 3 Seminar Tutorial 1 Lab 1 Other

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

Dr. C. Sparrey, Dr. E. Park

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**.

MSE 220 (or ENSC 231), MSE 222 (or ENSC 282).

COREQUISITE

None.

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

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:

The required laboratory supplies are available at Surrey. New texts will be requested for the library at Surrey.

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.

Biomedical Physiology and Kinesiology, Engineering Science

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 _____

COURSE SUBJECT/NUMBER

COURSE TITLE

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

MSE 422-4 Fuel Cell Systems

AND

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

Fuel Cell Systems

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.

The scientific and engineering aspects of fuel cell systems, with emphasis on fundamental electrochemistry, applied thermodynamics, and transport phenomena. Students will apply course concepts within hands-on laboratory projects that design, model/simulate, build, and test microfluidic fuel cell devices.

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

The objective is to teach the MSE students about fuel cells in the context of mechatronic systems and prepare them for a career in the energy sector.

SCHEDULING AND ENROLLMENT INFORMATION

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

Offered once a year in either Spring or Summer terms depending on MSE needs and faculty teaching load. Effective September 2013.

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): 4

Indicate number of hours for: Lecture 3 Seminar 0 Tutorial 1 Lab 0 Other

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

Dr. E. Kjeang and Dr. M. Bahrami

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**.

MSE 223 (or ENSC 283), MSE 321 (or ENSC 388)

COREQUISITE

None

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

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:

There are four essential laboratory elements involving fuel cell design, modeling, fabrication, and testing. The labs will utilize the space, equipment, and software purchased for the microfluidics course. In addition, fuel cell testing equipment and supplies are required. TAs are essential to supervise lab activities.

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.

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 _____

COURSE SUBJECT/NUMBER

COURSE TITLE

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

MSE 423-4 Energy Conversion

AND

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

Energy Conversion

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.

Provides a detailed understanding of thermal energy conversion systems on the basis of the laws of thermodynamics. A main goal is to understand the processes in a broad variety of energy converging devices (e.g. power cycles). Some emphasis will be put on the study of the efficiency of energy conversion devices and efficiency improvements by changing the process details.

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

To provide an elective course for MSE students who are interested to pursue a carrier in energy sector.

SCHEDULING AND ENROLLMENT INFORMATION

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

Offered once a year in either Spring or Summer terms depending on MSE needs and faculty teaching load. Effective September 2013.

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): 4

Indicate number of hours for: Lecture 3 Seminar 1 Tutorial Lab Other

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

Dr. M. Bahrami and Dr. E. Kjeang

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**.

MSE 223 (or ENSC 283), MSE 321 (or ENSC 388, or PHYS 344)

COREQUISITE

None

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

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:

There are two laboratory experiments, a "diesel engine" which can run as heat engine, and a "HVAC" experiment. The lab for the course is almost ready, i.e. the diesel engine is ready to operate. A HVAC equipment should be purchased. TAs will supervise lab activities.

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.

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 _____

COURSE SUBJECT/NUMBER

COURSE TITLE

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

MSE 424-4 Microfluidics

AND

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

Microfluidics

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.

The fundamentals and applications of transport phenomena in microstructures. The main objective is to understand the linkages between theoretical processes and practical applications, with particular emphasis on mechatronic systems. Microfluidic tools and methods will be applied in hands-on laboratory projects that design, model/simulate, build, and test microfluidic devices.

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

The objective is to teach the MSE students how to apply microfluidic tools and methods in the context of mechatronic systems.

SCHEDULING AND ENROLLMENT INFORMATION

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

Offered once a year in either Spring or Summer terms depending on MSE needs and faculty teaching load. Effective September 2013.

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): 4

Indicate number of hours for: Lecture 3 Seminar Tutorial 1 Lab 2 Other

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

Dr. E. Kjeang and Dr. M. Bahrami

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.**

MSE 223 (or ENSC 283), MSE 321 (or ENSC 388)

COREQUISITE

None

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

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:

There are four essential laboratory elements involving design, modeling, microfabrication, and microfluidic experimentation. Space needs to be assigned and equipment and supplies to be purchased, installed, and commisioned prior to the first course offering. Fume hood access is required. COMSOL Multiphysics software required for modeling. TAs to supervise lab activities.

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.

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 _____

COURSE SUBJECT/NUMBER

COURSE TITLE

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

MSE 425-4 Nano Manufacturing for Nano-scale Devices

AND

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

Nano Manufacturing

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.

Fundamentals of nanotechnology, nanofabrication and state of the art in nanomanufacturing engineering. Value-added processes to control matter at the nanoscale in one, two, and three dimensions for reproducible, commercial-scale production. Introduction to nanofabrication techniques, processes, and nanometer products.

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 newly designed by new faculty member for nanotechnology and nano fabrications.

SCHEDULING AND ENROLLMENT INFORMATION

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

Annually in the summer term. Effective September 2013.

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): 4

Indicate number of hours for: Lecture 3 Seminar Tutorial 1 Lab 1 Other

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

Dr. Behraad Bahreyni

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.**

CHEM 120, PHYS 140, PHYS 141

COREQUISITE

none

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

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

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.

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 _____

SFU OFFICE OF THE ASSOCIATE VICE-PRESIDENT, ACADEMIC AND ASSOCIATE PROVOST

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MEMORANDUM

ATTENTION	Senate	**DATE**	March 22, 2013
FROM	Gordon Myers, Chair Senate Committee on Undergraduate Studies	**PAGES**	1/1
RE:	Faculty of Applied Sciences (SCUS 13-10)		

For information:

Acting under delegated authority, SCUS conducted an electronic vote and approved the following curriculum revisions effective Fall 2013:

1. School of Engineering Science (SCUS 13-10a)

(i) New Course Proposal:
ENSC 120-1, Introduction to electronics laboratory instruments operation and measurement techniques
ENSC 180-3, Introduction to Engineering Analysis

(ii) Prerequisite change to ENSC 220, 380
(iii) Requirement changes to the Engineering Science, Major, Computer Engineering Option
(iv) Requirement changes to the Engineering Science, Major, Electronics Engineering Option
(v) Requirement changes to the Engineering Science Major, Systems Option
(vi) Requirement changes to the Engineering Science Honours, Biomedical Engineering Option (deletion of the three concentrations)
(vii) Requirement changes to the Engineering Science Honours, Computer Engineering Option
(viii) Requirement changes to the Engineering Science Honours, Electronics Engineering Option
(ix) Requirement changes to the Engineering Science Honours, Engineering Physics Option
(x) Requirement changes to the Engineering Science Honours, Systems Option

Engineering Science 2013-2014 Curriculum Revision
Faculty of Applied Sciences Curriculum Committee
Atousa Hajshirmohammadi and Robert D. Cameron
March 21, 2013

Introduction

The School of Engineering Science proposes two overall curriculum changes for 2013-14: a new common first-year curriculum for the all engineering science and consolidation and streamlining of the biomedical engineering option.

First-year Curriculum

The essence of the first-year curriculum change is to create a stronger cohort experience and better preparation for engineering work through the introduction of ENSC 120-1 as a new first semester course in electronics engineering instrumentation, and of ENSC 180-3 as a new second semester course in engineering analysis. ENSC 120-1 replaces PHYS 131-2 in the curriculum, while ENSC 180-3 will be accommodated by the compression of ENSC 150, ENSC 215 and ENSC 250 into a two-course sequence. That compression will be introduced for 2014-2015. In addition, the ENSC 101W-1 and ENSC 102 courses are replaced by ENSC 105W-3.

Biomedical Engineering Option

The change here is to eliminate the notion of specialized concentrations as suboptions to this option. Maintaining three separate concentrations that differ only in some elective requirements is unsustainable. The new structure going forward is implemented by deleting two of the concentrations (premedical, biomedical signals and instrumentation) and modifying the remaining concentration.

Summary of Changes

1. New course proposals:
   a) ENSC 120-1 Introduction to Electronics Laboratory Instruments
   b) ENSC 180-3 Introduction to Engineering Analysis
   The new course proposals and outlines are attached.
2. Course prerequisite changes: ENSC 220 and ENSC 380.
3. Revisions to the index of ENSC options.
4. Revisions to each of the ENSC options as shown below.
   a) Changes to the Engineering Science Major, Computer Engineering Option
   b) Changes to the Engineering Science Major, Electronics Engineering Option
   c) Changes to the Engineering Science Major, Systems Option
   d) Changes to Engineering Science Honours, Biomedical Engineering Option
      - consolidate "concentrations"
   e) Changes to Engineering Science Honours, Computer Engineering Option
   f) Changes to Engineering Science Honours, Electronics Engineering Option
   g) Changes to Engineering Science Honours, Engineering Physics Option
   h) Changes to Engineering Science Honours, Systems Option

Changes to the Index of Engineering Science Options

Note: mechatronics entries are shown as removed in both "current" and "proposed" entries, reflecting the expected summer 2013 calendar.

Current	Proposed
Undergraduate programs The following undergraduate programs are offered. • major, computer engineering option (bachelor of applied science) • major, electronics engineering option (bachelor of applied science) • major, systems option (bachelor of applied science) • honours, biomedical engineering option with biomedical signals and instrumentation concentration (bachelor of applied science) • honours, biomedical engineering option with pre-med concentration (bachelor of applied science) • honours, biomedical engineering option with rehabilitation and assistive devices concentration (bachelor of applied science) • honours, computer engineering option (bachelor of applied science) • honours, electronics engineering option (bachelor of applied science) • honours, engineering physics (electronics) option (bachelor of applied science) • honours, systems option (bachelor of applied science) • minor, computer and electronics design	**Undergraduate programs** The following undergraduate programs are offered. • major, computer engineering option (bachelor of applied science) • major, electronics engineering option (bachelor of applied science) • major, systems option (bachelor of applied science) • honours, biomedical engineering option (bachelor of applied science) • honours, computer engineering option (bachelor of applied science) • honours, electronics engineering option (bachelor of applied science) • honours, engineering physics (electronics) option (bachelor of applied science) • honours, systems option (bachelor of applied science) • minor, computer and electronics design

Changes to the Engineering Science Major, Computer Engineering Option

This change updates the calendar text to reflect the new core courses ENSC 105W, ENSC 120 and ENSC 180. ENSC 101W, ENSC 101 and PHYS 131 are deleted from the curriculum.

Current	Proposed
Core Course Requirements Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 225 Data Structures and Programming (3) • CMPT 275 Software Engineering I (4) • CMPT 300 Operating Systems I (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • ~~ENSC 101 Writing Process, Persuasion and Presentations (1)~~ • ~~ENSC 102 Form and Style in Professional Genres (1)~~ • ENSC 150 Introduction to Computer Design (3) • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 224 Electronic Devices (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4)	**Core Course Requirements** Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 225 Data Structures and Programming (3) • CMPT 275 Software Engineering I (4) • CMPT 300 Operating Systems I (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • **ENSC 105W Process, Form and Convention in Professional Genres (1)** • **ENSC 120 Introduction to Electronics Laboratory Instruments (1)** • ENSC 150 Introduction to Computer Design (3) • **ENSC 180 Introduction to Engineering Analysis (3)** • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 224 Electronic Devices (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1)

Current	Proposed
• ENSC 350 Digital Systems Design (3) • ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 450 VLSI Systems Design (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • MACM 101 Discrete Mathematics I (3) • MACM 201 Discrete Mathematics II (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics * (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism * (4) ~~• PHYS 131 Physics Laboratory I * (2)~~ • STAT 270 Introduction to Probability and Statistics (3) ~~*students with credit for both PHYS 140 and 141 are not required to complete PHYS 131~~	• ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 350 Digital Systems Design (3) • ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 450 VLSI Systems Design (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • MACM 101 Discrete Mathematics I (3) • MACM 201 Discrete Mathematics II (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism (4) • STAT 270 Introduction to Probability and Statistics (3)

Changes to the Engineering Science Major, Electronics Engineering Option

This change updates the calendar text to reflect the new core courses ENSC 105W, ENSC 120 and ENSC 180. ENSC 101W, ENSC 101 and PHYS 131 are deleted from the curriculum.

Current	Proposed
Core Course Requirements Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) ~~• ENSC 101 Writing Process, Persuasion and Presentations (1)~~ ~~• ENSC 102 Form and Style in Professional Genres (1)~~ • ENSC 150 Introduction to Computer Design (3) • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 224 Electronic Devices (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 330 Engineering Materials (4) • ENSC 350 Digital Systems Design (3) • ENSC 351 Real Time and Embedded	**Core Course Requirements** Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • **ENSC 105W Process, Form and Convention in Professional Genres (1)** • **ENSC 120 Introduction to Electronics Laboratory Instruments (1)** • ENSC 150 Introduction to Computer Design (3) • **ENSC 180 Introduction to Engineering Analysis (3)** • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 224 Electronic Devices (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 330 Engineering Materials (4)

Current	Proposed
Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 254 Vector and Complex Analysis for Applied Sciences (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics * (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism * (4) ~~• PHYS 131 Physics Laboratory I * (2)~~ • PHYS 321 Intermediate Electricity and Magnetism (3) • PHYS 421 Electromagnetic Waves (3) • STAT 270 Introduction to Probability and Statistics (3) ~~*students with credit for both PHYS 140 and 141 are not required to complete PHYS 131~~	• ENSC 350 Digital Systems Design (3) • ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 254 Vector and Complex Analysis for Applied Sciences (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism (4) • PHYS 321 Intermediate Electricity and Magnetism (3) • PHYS 421 Electromagnetic Waves (3) • STAT 270 Introduction to Probability and Statistics (3)

Changes to the Engineering Science Major, Systems Option

This change updates the calendar text to reflect the new core courses ENSC 105W, ENSC 120 and ENSC 180. ENSC 101W, ENSC 101 and PHYS 131 are deleted from the curriculum.

Current	Proposed
Core Course Requirements Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 225 Data Structures and Programming (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • ~~ENSC 101 Writing Process, Persuasion and Presentations (1)~~ • ~~ENSC 102 Form and Style in Professional Genres (1)~~ • ENSC 150 Introduction to Computer Design (3) • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 225 Microelectronics I (4) • ENSC 230 Introduction to Mechanical Design (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 330 Engineering Materials (4)	**Core Course Requirements** Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 225 Data Structures and Programming (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • **ENSC 105W Process, Form and Convention in Professional Genres (1)** • **ENSC 120 Introduction to Electronics Laboratory Instruments (1)** • ENSC 150 Introduction to Computer Design (3) • **ENSC 180 Introduction to Engineering Analysis (3)** • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 225 Microelectronics I (4) • ENSC 230 Introduction to Mechanical Design (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3)

Current	Proposed
• ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 387 Introduction to Electro-Mechanical Sensors and Actuators (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 483 Modern Control Systems (4) • ENSC 488 Introduction to Robotics (4) • ENSC 489 Computer Aided Design and Manufacturing (4) • MACM 101 Discrete Mathematics I (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics * (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism * (4) ~~• PHYS 131 Physics Laboratory I * (2)~~ • PHYS 221 Electromagnetics (3) • STAT 270 Introduction to Probability and Statistics (3) ~~*students with credit for both PHYS 140 and 141 are not required to complete PHYS 131~~	• ENSC 325 Microelectronics II (4) • ENSC 330 Engineering Materials (4) • ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 387 Introduction to Electro-Mechanical Sensors and Actuators (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 483 Modern Control Systems (4) • ENSC 488 Introduction to Robotics (4) • ENSC 489 Computer Aided Design and Manufacturing (4) • MACM 101 Discrete Mathematics I (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism (4) • PHYS 221 Electromagnetics (3) • STAT 270 Introduction to Probability and Statistics (3)

Changes to Engineering Science Honours, Biomedical Engineering Option

This change updates the calendar text to reflect the new core courses ENSC 105W, ENSC 120 and ENSC 180. ENSC 101W, ENSC 101 and PHYS 131 are deleted from the curriculum. In addition, the three concentrations are consolidated into a single option. This is shown by changes to the calendar text of the "biomedical signals and instrumentation concentration." The other two options are removed.

Current	Proposed
Engineering Science Honours Program, Biomedical Engineering Option (with a Biomedical Signals and Instrumentation Concentration)	***[delete this entry entirely]***
Engineering Science Honours, Biomedical Engineering Option (with a Pre-Medical Concentration)	***[delete this entry entirely]***
Engineering Science Honours, Biomedical Engineering Option ~~(with a Rehabilitation and Assistive Devices Concentration)~~	**Engineering Science Honours Program, Biomedical Engineering Option**
Core Course Requirements Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CHEM 180 The Chemistry of Life (3) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 225 Data Structures and Programming (3) • ENSC 100 Engineering Technology and Society (3) ~~• ENSC 101 Writing Process, Persuasion and Presentations (1)~~ ~~• ENSC 102 Form and Style in Professional Genres (1)~~ • ENSC 150 Introduction to Computer Design (3) • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for	**Core Course Requirements** Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CHEM 180 The Chemistry of Life (3) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 225 Data Structures and Programming (3) • ENSC 100 Engineering Technology and Society (3) • **ENSC 105W Process, Form and Convention in Professional Genres (1)** • **ENSC 120 Introduction to Electronics Laboratory Instruments (1)** • ENSC 150 Introduction to Computer Design (3) • **ENSC 180 Introduction to Engineering Analysis (3)** • ENSC 201 The Business of Engineering

Current	Proposed
Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 330 Engineering Materials (4) • ENSC 350 Digital Systems Design (3) • ENSC 370 Biomedical Engineering Directions (3) • ENSC 372 Biomedical Instrumentation (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • GERO 300 Introduction to Gerontology * (3) • KIN 201 Biomechanics (3) • KIN 208 Introduction to Physiological Systems (3) • KIN 308 Experiments and Models in Systems Physiology (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 254 Vector and Complex Analysis for Applied Sciences (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics	(3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 330 Engineering Materials (4) • ENSC 350 Digital Systems Design (3) • ENSC 370 Biomedical Engineering Directions (3) • ENSC 372 Biomedical Instrumentation (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • GERO 300 Introduction to Gerontology * (3) • KIN 201 Biomechanics (3) • KIN 208 Introduction to Physiological Systems (3) • KIN 308 Experiments and Models in Systems Physiology (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 254 Vector and Complex Analysis for Applied Sciences (3) • MATH 310 Introduction to Ordinary

Current	Proposed
(3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics ** (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism ** (4) ~~• PHYS 131 Physics Laboratory I ** (2)~~ • PHYS 321 Intermediate Electricity and Magnetism (3) • STAT 270 Introduction to Probability and Statistics (3) *or any B-Soc course ~~**students with credit for both PHYS 140 and 141 are not required to complete PHYS 131~~	Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism (4) • PHYS 321 Intermediate Electricity and Magnetism (3) • STAT 270 Introduction to Probability and Statistics (3) *or any B-Soc course
Engineering Science Elective Courses As well, students must complete four engineering science elective courses, two of which must be chosen from ENSC 300 or 400 division courses, and two of which must be chosen from only ENSC 400 division courses. ~~The choice will be constrained by those that are appropriate for the biomedical signals and instrumentation concentration.~~	**Engineering Science Elective Courses** As well, students must complete four engineering science elective courses, two of which must be chosen from ENSC 300 or 400 division courses, and two of which must be chosen from only ENSC 400 division courses.

Changes to Engineering Science Honours, Computer Engineering Option

This change updates the calendar text to reflect the new core courses ENSC 105W, ENSC 120 and ENSC 180. ENSC 101W, ENSC 101 and PHYS 131 are deleted from the curriculum.

Current	Proposed
Core Course Requirements Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 275 Software Engineering I (4) • CMPT 300 Operating Systems I (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) ~~• ENSC 101 Writing Process, Persuasion and Presentations (1)~~ ~~• ENSC 102 Form and Style in Professional Genres (1)~~ • ENSC 150 Introduction to Computer Design (3) • ENSC 201 The Business of Engineering (3) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 350 Digital Systems Design (3) • ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science	**Core Course Requirements** Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 275 Software Engineering I (4) • CMPT 300 Operating Systems I (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • **ENSC 105W Process, Form and Convention in Professional Genres (1)** • **ENSC 120 Introduction to Electronics Laboratory Instruments (1)** • ENSC 150 Introduction to Computer Design (3) • **ENSC 180 Introduction to Engineering Analysis (3)** • ENSC 201 The Business of Engineering (3) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 350 Digital Systems Design (3) • ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and

Current	Proposed
Project (4) • ENSC 450 VLSI Systems Design (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • MACM 101 Discrete Mathematics I (3) • MACM 201 Discrete Mathematics II (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics * (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism * (4) ~~• PHYS 131 Physics Laboratory I * (2)~~ • STAT 270 Introduction to Probability and Statistics (3) ~~*students with credit for both PHYS 140 and 141 are not required to complete PHYS 131~~	Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 450 VLSI Systems Design (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • MACM 101 Discrete Mathematics I (3) • MACM 201 Discrete Mathematics II (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism (4) • STAT 270 Introduction to Probability and Statistics (3)

Changes to Engineering Science Honours, Electronics Engineering Option

This change updates the calendar text to reflect the new core courses ENSC 105W, ENSC 120 and ENSC 180. ENSC 101W, ENSC 101 and PHYS 131 are deleted from the curriculum.

Current	Proposed
Core Course Requirements Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) ~~• ENSC 101 Writing Process, Persuasion and Presentations (1)~~ ~~• ENSC 102 Form and Style in Professional Genres (1)~~ • ENSC 150 Introduction to Computer Design (3) • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 224 Electronic Devices (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 330 Engineering Materials (4) • ENSC 350 Digital Systems Design (3) • ENSC 351 Real Time and Embedded	**Core Course Requirements** Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • **ENSC 105W Process, Form and Convention in Professional Genres (1)** • **ENSC 120 Introduction to Electronics Laboratory Instruments (1)** • ENSC 150 Introduction to Computer Design (3) • **ENSC 180 Introduction to Engineering Analysis (3)** • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 224 Electronic Devices (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 330 Engineering Materials (4)

Current	Proposed
Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 254 Vector and Complex Analysis for Applied Sciences (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics * (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism * (4) ~~• PHYS 131 Physics Laboratory I * (2)~~ • PHYS 321 Intermediate Electricity and Magnetism (3) • PHYS 421 Electromagnetic Waves (3) • STAT 270 Introduction to Probability and Statistics (3) ~~*students with credit for both PHYS 140 and 141 are not required to complete PHYS 131~~	• ENSC 350 Digital Systems Design (3) • ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 254 Vector and Complex Analysis for Applied Sciences (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism (4) • PHYS 321 Intermediate Electricity and Magnetism (3) • PHYS 421 Electromagnetic Waves (3) • STAT 270 Introduction to Probability and Statistics (3)

Changes to Engineering Science Honours, Engineering Physics Option

This change updates the calendar text to reflect the new core courses ENSC 105W, ENSC 120 and ENSC 180. ENSC 101W, ENSC 101 and PHYS 131 are deleted from the curriculum.

Current	Proposed
Core Course Requirements Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • ~~ENSC 101 Writing Process, Persuasion and Presentations (1)~~ • ~~ENSC 102 Form and Style in Professional Genres (1)~~ • ENSC 150 Introduction to Computer Design (3) • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4)	**Core Course Requirements** Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • **ENSC 105W Process, Form and Convention in Professional Genres (1)** • **ENSC 120 Introduction to Electronics Laboratory Instruments (1)** • ENSC 150 Introduction to Computer Design (3) • **ENSC 180 Introduction to Engineering Analysis (3)** • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 225 Microelectronics I (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 327 Communication Systems (4) • ENSC 351 Real Time and Embedded Systems (4)

Current	Proposed
• ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 254 Vector and Complex Analysis for Applied Sciences (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics * (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism * (4) ~~• PHYS 131 Physics Laboratory I * (2)~~ • PHYS 211 Intermediate Mechanics (3) • PHYS 233 Physics Laboratory III (2) • PHYS 321 Intermediate Electricity and Magnetism (3) • PHYS 332W Optics Laboratory (4) • PHYS 344 Thermal Physics (3) • PHYS 365 Semiconductor Device Physics (3) • PHYS 384 Methods of Theoretical Physics I (3) • PHYS 385 Quantum Mechanics I (3) • PHYS 421 Electromagnetic Waves (3) • PHYS 455 Modern Optics (3) • STAT 270 Introduction to Probability and Statistics (3) ~~*students with credit for both PHYS 140 and 141 are not required to complete PHYS 131~~	• ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 498 Engineering Science Thesis Proposal (3) • ENSC 499 Engineering Science Undergraduate Thesis (9) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 254 Vector and Complex Analysis for Applied Sciences (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism (4) • PHYS 211 Intermediate Mechanics (3) • PHYS 233 Physics Laboratory III (2) • PHYS 321 Intermediate Electricity and Magnetism (3) • PHYS 332W Optics Laboratory (4) • PHYS 344 Thermal Physics (3) • PHYS 365 Semiconductor Device Physics (3) • PHYS 384 Methods of Theoretical Physics I (3) • PHYS 385 Quantum Mechanics I (3) • PHYS 421 Electromagnetic Waves (3) • PHYS 455 Modern Optics (3) • STAT 270 Introduction to Probability and Statistics (3)

Changes to Engineering Science Honours, Systems Option

This change updates the calendar text to reflect the new core courses ENSC 105W, ENSC 120 and ENSC 180. ENSC 101W, ENSC 101 and PHYS 131 are deleted from the curriculum.

Current	Proposed
Core Course Requirements Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 225 Data Structures and Programming (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) ~~• ENSC 101 Writing Process, Persuasion and Presentations (1)~~ ~~• ENSC 102 Form and Style in Professional Genres (1)~~ • ENSC 150 Introduction to Computer Design (3) • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 225 Microelectronics I (4) • ENSC 230 Introduction to Mechanical Design (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 330 Engineering Materials (4)	**Core Course Requirements** Students complete all of • CHEM 121 General Chemistry and Laboratory I (4) • CMPT 128 Introduction to Computing Science and Programming for Engineers (3) • CMPT 225 Data Structures and Programming (3) • ECON 103 Principles of Microeconomics (4) • ENSC 100 Engineering Technology and Society (3) • **ENSC 105W Process, Form and Convention in Professional Genres (1)** • **ENSC 120 Introduction to Electronics Laboratory Instruments (1)** • ENSC 150 Introduction to Computer Design (3) • **ENSC 180 Introduction to Engineering Analysis (3)** • ENSC 201 The Business of Engineering (3) • ENSC 204 Graphical Communication for Engineering (1) • ENSC 215 Microcontroller Interfacing and Assembly-Language Programming (3) • ENSC 220 Electric Circuits I (3) • ENSC 225 Microelectronics I (4) • ENSC 230 Introduction to Mechanical Design (4) • ENSC 250 Introduction to Computer Architecture (3) • ENSC 304 Human Factors and Usability Engineering (1) • ENSC 305 Project Documentation and Team Dynamics (1) • ENSC 320 Electric Circuits II (3) • ENSC 325 Microelectronics II (4) • ENSC 330 Engineering Materials (4)

Current	Proposed
• ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 387 Introduction to Electro-Mechanical Sensors and Actuators (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 483 Modern Control Systems (4) • ENSC 488 Introduction to Robotics (4) • ENSC 489 Computer Aided Design and Manufacturing (4) • MACM 101 Discrete Mathematics I (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics * (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism * (4) ~~• PHYS 131 Physics Laboratory I * (2)~~ • PHYS 221 Electromagnetics (3) • STAT 270 Introduction to Probability and Statistics (3) ~~*students with credit for both PHYS 140 and 141 are not required to complete PHYS 131~~	• ENSC 351 Real Time and Embedded Systems (4) • ENSC 380 Linear Systems (3) • ENSC 383 Feedback Control Systems (4) • ENSC 387 Introduction to Electro-Mechanical Sensors and Actuators (4) • ENSC 406 Engineering Ethics, Law, and Professional Practice (2) • ENSC 440 Capstone Engineering Science Project (4) • ENSC 483 Modern Control Systems (4) • ENSC 488 Introduction to Robotics (4) • ENSC 489 Computer Aided Design and Manufacturing (4) • MACM 101 Discrete Mathematics I (3) • MACM 316 Numerical Analysis I (3) • MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (4) • MATH 152 Calculus II (3) • MATH 232 Applied Linear Algebra (3) • MATH 251 Calculus III (3) • MATH 310 Introduction to Ordinary Differential Equations (3) • PHYS 120 Mechanics and Modern Physics (3) or PHYS 125 Mechanics and Special Relativity (3) or PHYS 140 Studio Physics - Mechanics and Modern Physics (4) • PHYS 121 Optics, Electricity and Magnetism (3) or PHYS 126 Electricity, Magnetism and Light (3) or PHYS 141 Studio Physics - Optics, Electricity and Magnetism (4) • PHYS 221 Electromagnetics (3) • STAT 270 Introduction to Probability and Statistics (3)