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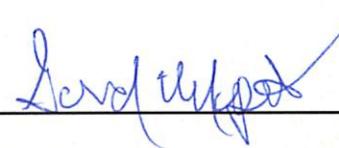
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MEMORANDUM

ATTENTION	Senate	**DATE**	November 7, 2014
FROM	Gordon Myers, Chair	**PAGES**	1/1
	Senate Committee on		
	Undergraduate Studies		
RE:	Faculty of Applied Sciences		

For information:

Acting under delegated authority at its meeting of November 6, 2014 SCUS approved the following curriculum revisions.

1. <u>School of Engineering Science (SCUS 14-37)</u>

    (i) Course description, number and prerequisite change to ENSC 201
    (ii) Course number and prerequisite change to ENSC 224, 230, 281, 372, 374
    (iii) Prerequisite change to ENSC 411
    (iv) Program requirement changes to all ENSC options
    (v) Revisions to the Engineering Science options:
        • ENSC Major, Computer Engineering Option
        • ENSC Major, Electronics Engineering Option
        • ENSC Major, Systems Option
        • ENSC Honours, Biomedical Engineering Option
        • ENSC Honours, Computer Engineering Option
        • ENSC Honours, Electronics Engineering Option
        • ENSC Honours, Engineering Physics Option
        • ENSC Honours, Systems Option
    (vi) Prerequisite change to ENSC 327, 328

2. <u>School of Computing Science (SCUS 14-42)</u>

    (i) Lower Division requirement changes to the CS Major Program
    (ii) Requirement changes to the CS Honours Program
    (iii) Requirement changes to the Software Systems Major Program
    (iv) Description changes to CMPT 100, 120, 166
    (v) Prerequisite changes to CMPT 261, 340, 468
    (vi) Description and prerequisite changes to CMPT 170, 375

SFU

FACULTY OF APPLIED SCIENCES

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MEMORANDUM ──

ATTENTION	Senate Committee on Undergraduate Studies	**DATE**	October 15, 2014
FROM	Ed Park, Associate Dean	**PAGES**	
RE:	Old Business – changes tabled at Oct 2 SCUS meeting		
	ENSC 327, 328 – oversight correction		
	New Business – CMPT changes		

The following changes have been approved by the FAS Undergraduate Curriculum Committee and are appended here for approval by SCUS and recommendation to Senate.

1.) Old Business - School of Engineering Science
   a. Course Changes (tabled at Oct 2 meeting)
      i. ENSC 201/410 – course description change, renumbering, pre-requisite change
      ii. ENSC 224/324 – renumbering, pre-requisite change
      iii. ENSC 230/386 – renumbering, pre-requisite change
      iv. ENSC 281/385 – renumbering, pre-requisite change
      v. ENSC 372/475 - renumbering, pre-requisite change
      vi. ENSC 374/477 - renumbering, pre-requisite change
      vii. ENSC 411 - pre-requisite change

   b. Calendar revisions (tabled at Oct 2 meeting)
      i. Change to the program requirements section – all ENSC options
      ii. Changes to the Engineering Science Major, Computer Engineering Option
      iii. Changes to the Engineering Science Major, Electronics Engineering Option
      iv. Changes to the Engineering Science Major, Systems Option
      v. Changes to Engineering Science Honours, Biomedical Engineering Option
      vi. Changes to Engineering Science Honours, Computer Engineering Option
      vii. Changes to Engineering Science Honours, Electronics Engineering Option
      viii. Changes to Engineering Science Honours, Engineering Physics Option
      ix. Changes to Engineering Science Honours, Systems Option

c. Pre-requisite Changes (Oversight Correction – changes applied incorrectly to forms sent back from Aug 7 SCUS meeting)
    i. ENSC 327
    ii. ENSC 328

2.) School of Computing Science (New Business)
  a. Calendar Changes
    i. Removal of CMPT 250 as a Lower Division Requirement from the CS Major Program
    ii. Correction to the Depth Requirement for the CS Honours Program
    iii. Removal of Specialization Requirements from the Software Systems Major Program

  b. Course Description Changes
    i. CMPT 100
    ii. CMPT 120
    iii. CMPT 166

  c. Course Pre-requisite Changes
    i. CMPT 261
    ii. CMPT 340
    iii. CMPT 468

  d. Course Description and Pre-requisite Changes
    i. CMPT 170
    ii. CMPT 375

Thank you,

Edward Park
Associate Dean

(EP/mt)

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Faculty of Applied Sciences Curriculum Committee

Lesley Shannon and Ed Park
September 2014

The School of Engineering Science proposes a new third and fourth year curriculum for all the engineering science options. This will complete the curriculum revision of our program. It includes the removal of some previously required courses (e.g. ENSC 305W, ENSC 330), the addition of some new course sequences (e.g. ENSC 405W-ENSC 440) and the renumbering of existing courses to correctly reflect their course level (ENSC 201, 224, 230 and 281). Finally, each option has now defined a unique set of mandatory core courses to clearly differentiate them and we have indicated that any course substitutions from the specified course requirements for each option must be pre-approved to meet graduation requirements.

1. Course prerequisite changes: ENSC 201/410, ENSC 224/324, ENSC 230/386, ENSC 281/385, ENSC 372/475, ENSC 374/477, ENSC 411,
2. Course Description Change: ENSC 201/410
3. Course Re-Numbering: ENSC 201/410, ENSC 224/324, ENSC 230/386, ENSC 281/385, ENSC 372/475, ENSC 374/477,
4. Revisions to all ENSC option calendars – program requirements
5. 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
   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

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 ___ ENSC 201 _____

TO
Course Subject/Number ___ ENSC 410 _____

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:

This course covers the business, management and entrepreneurial concepts that are important to engineers who manage projects, run businesses, or need to decide on the most efficient method for accomplishing a task. The topics to be covered include: financial accounting, rates of return, taxes, cost-benefit analyses, marketing, financing methods, and business plans. Students cannot complete both this course and ENSC 411 for credit.

DESCRIPTION

TO:

This course covers the business, management and entrepreneurial concepts that are important to engineers who manage projects, run businesses, or need to decide on the most efficient method for accomplishing a task. The topics to be covered include: financial accounting, rates of return, taxes, cost-benefit analyses, marketing, financing methods, and business plans. Students with credit for ENSC 201, ENSC 411, or MSE 300 cannot complete this course for further credit.

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: A minimum of 80 units is required to enroll in this course.

LEARNING OUTCOMES

RATIONALE

This course is taken by our students in 4th year so the re-numbering is to reflect the level at which the course is taken.

All 4th year courses in our program now require a minimum of 80 units (as reflected by the new prereq)

The description is updated to reflect that the course content of MSE 300 is very similar to ENSC 201 so students should not be permitted to complete both courses for credit.

Effective term and year
Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number __ENSC 224_____

TO
Course Subject/Number __ENSC 324_____

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: ENSC 220, MATH 232, and MATH 310 or equivalents.

TO: (ENSC 220 or MSE 250), MATH 232, and MATH 310. Students who have taken ENSC 224 cannot take ENSC 324 for further credit.

DESCRIPTION

LEARNING OUTCOMES

RATIONALE

1 - This course is commonly taken as a third year course and will be part of the third year curriculum going forward; the renumbering clarifies its reality and sequencing for our students.
2 - MSE equivalents are being added to the list of acceptable prerequisites.

Effective term and year   Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number __ENSC 230_____

TO
Course Subject/Number __ENSC 386_____

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: PHYS 120, MATH 310

PREREQUISITE

TO: PHYS 120, MATH 310, and (ENSC 281 or ENSC 385). Students who have previously taken ENSC 230 cannot take this course for credit.

DESCRIPTION

LEARNING OUTCOMES

RATIONALE

ENSC 281 has been renumbered as ENSC 385 and we would like to make this course a pre-requisite for ENSC 386. Furthermore, ENSC 230 (old number) is equivalent to this course and should not be used for further credit.

Effective term and year
Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number __ ENSC 281 _____

TO
Course Subject/Number __ ENSC 385 _____

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: PHYS 140, MATH 152.

PREREQUISITE

TO: (PHYS 120 or PHYS 140) and MATH 152. Students with credit for ENSC 281 or MSE 221 cannot take this course for further credit. ⌐ DESCRIPTION

LEARNING OUTCOMES

RATIONALE

Our students take PHYS 120, not PHYS 140, so this pre-requisite would be confusing for students.

MSE equivalents (ENSC 281 and MSE 221) are being noted as equivalents.

Effective term and year
Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

Indicate number of hours for: Lecture __3__ Seminar _____ Tutorial _____ Lab __1__

FROM
Course Subject/Number __ENSC 372__

TO
Course Subject/Number __ENSC 475__

Credits __4__

Credits __4__

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

FROM:

Biomedical Instrumentation

TO:

same

(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: ENSC 225, 320, 380 and KIN 308. KIN 308 can be taken concurrently

TO: (ENSC 225 or MSE 251), ENSC 320, (ENSC 380 or MSE 280) and a minimum of 80 units. ENSC 380/MSE 280 can be taken concurrently. Students with ENSC 372 cannot take this course for further credit.] DESCRIPTION

LEARNING OUTCOMES

RATIONALE

-The course is being changed from 3rd to 4th year due to curriculum revision and an increase the level of the course material.
-MSE equivalents (MSE 251 and MSE 280) are being added to the list of acceptable prerequisites. Students are excluded from taking the fourth year course if they took the original third year course due to overlap.
-KIN 308 has been removed because the material is unnecessary.
-All of our 4th year courses have a minimum 80 unit requirement.

Effective term and year

Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

Indicate number of hours for: Lecture __3__ Seminar_____ Tutorial _____ Lab __1__

FROM
Course Subject/Number __ENSC 374__

TO
Course Subject/Number __ENSC 477__

Credits __4__

Credits __4__

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

FROM:

Biomedical Image Acquisition

TO:

same

(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: ENSC 220, 225, Recommended: ENSC 224

PREREQUISITE

TO: (ENSC 380 or MSE 280) and a minimum of 80 units. Students with ENSC 374 cannot take this course for further credit. *⌐ DESCRIPTION*

LEARNING OUTCOMES

RATIONALE

The course is being changed from 3rd to 4th year due to curriculum revision and an increase the level of the course material.

MSE equivalent (MSE 280) is being added to the list of acceptable prerequisites. Students are excluded from taking the fourth year course if they took the original third year course due to overlap.
ENSC 380 (and the MSE equivalent) provides the essential prerequisites for this course (including ENSC 220 as it is a prerequisite of ENSC 380). ENSC 224 and ENSC 225, microelectronic devices and circuits, are not relevant prequisites for this course and were removed.

All of our 4th year courses have a minimum 80 unit requirement.

Effective term and year

Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number_ENSC 411_____

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**.

PREREQUISITE

DESCRIPTION

FROM: Students with credit for ENSC 201 cannot complete this course for further credit. Students must have completed 90 units and have a GPA above 3.0.

TO: Students with credit for ENSC 201, ENSC 410 or MSE 300 cannot complete this course for further credit. Prerequisite: Students must have completed 90 units and have a GPA above 3.0.

LEARNING OUTCOMES

RATIONALE

The course content of MSE 300 and ENSC 410 is very similar to ENSC 411 so students should not be permitted to complete more than one of these courses for credit. ENSC 201 is being renumbered as ENSC 410.

Effective term and year Summer 2015

Changes to all Engineering Science Majors and Honours Programs

This change has been made to the second paragraph of *each* option Major and Honours Program Requirements section. This change is required to correctly reflect that our core course requirements comprise both technical and non-technical courses. Without the word "also," the sentence reads as if only non-technical courses are required.

Program Requirements	Program Requirements
...	...
This program's core course requirements consist of non-technical courses which broaden education and develop awareness of social, economic and managerial factors affecting engineering and scientific work.	This program's core course requirements *also* consist of non-technical courses which broaden education and develop awareness of social, economic and managerial factors affecting engineering and scientific work.

Changes to the Engineering Science Major, Computer Engineering Option

The changes to the engineering science major, computer engineering option course sequence reflect the following updates. 1) ENSC 100 has been renumbered as ENSC 100W as all of our students are required to take the W version of the course to meet WQB requirements for graduation. 2) ENSC 201 has been renumbered as ENSC 410 to reflect that it is in fact a fourth year course. We have also added ENSC 411 as an alternative to ENSC 410 as this option has existed for some time but has never been clearly stated. 3) ENSC 224 has been renumbered as ENSC 324 to reflect that it is in fact a third year course. 4) The following courses have been removed from the program: ENSC 304 as it will no longer be offered; ENSC 305W as it will no longer be offered (having been replaced by ENSC 405W); and ENSC 325 and 383 as they have both been changed from mandatory to elective courses. 5) The number of credit hours in the following courses have been changed: ENSC 220 has had the number of credit hours increased to correctly reflect the lab component of the course; ENSC 440 has had the number of credit hours reduced as we have created a new course (ENSC 405W) as a prerequisite to replace ENSC 304 and ENSC 305W with an increased number of credit hours. 6) ENSC 405W will now be our upper division W course for the program and the prerequisite in a mandatory two-course sequence for our capstone project course ENSC405W-ENSC440. 7) Furthermore, we are now only listing our preferred physics course sequence for our program (e.g. PHYS 120 and PHYS 121) Although we will still recognize the other sequences for transfer students, we prefer our students to take the desired course sequence. We have done the same thing with MATH 151, now clearly listing MATH 150 as an acceptable alternative instead of a preference. 8) Finally, we have added ENSC 429 as a required course for the computer curriculum as DSP is generally required in modern employment. We have now also listed that students can take either ENSC 450 or ENSC 452 as an upper division core course to increase the flexibility in the program for both students and course scheduling. Finally, we have rewritten the Core Course Requirements introduction to indicate that students must obtain prior approval to replace any of the required courses for their option curriculum with a substitution- independent of whether the APR check recognizes that they are equivalent.

Current	Proposed

Core Course Requirements (Current)

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 (3)
- ENSC 120 Introduction to Electronics

Core Course Requirements (Proposed)

The following core courses are required for the Engineering Science Major in Computer Engineering and cannot be substituted for "equivalent" courses in other areas without prior approval by the School. "Equivalent" courses taken without prior approval will not be applied to graduation requirements. Students should consult an academic advisor within their program for details on obtaining permission.

- 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)

- Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 201 The Business of Engineering (3)*
- ENSC 204 Graphical Communication for Engineering (1)
- ENSC 220 Electric Circuits I (3)
- ENSC 224 Electronic Devices (3)
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 304 Human Factors and Usability Engineering (1)
- ENSC 305 Project Documentation and Team Dynamics (1)
- ENSC 320 Electric Circuits II (4)
- ENSC 325 Microelectronics II (4)
- ENSC 327 Communication Systems (4)
- ENSC 350 Digital Systems Design (4)
- ENSC 351 Embedded and Real Time System Software (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)
- 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

- CMPT 275 Software Engineering I (4)
- CMPT 300 Operating Systems I (3)
- ECON 103 Principles of Microeconomics (4)
- ENSC 100W Engineering Technology and Society (3)
- ENSC 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques(1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 204 Graphical Communication for Engineering (1)
- ENSC 220 Electric Circuits I (4)
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 320 Electric Circuits II (4)
- ENSC 324 Electronic Devices (3)
- ENSC 327 Communication Systems (4)
- ENSC 350 Digital Systems Design (4)
- ENSC 351 Embedded and Real Time System Software (4)
- ENSC 380 Linear Systems (3)
- ENSC 405W Project Documentation, User Interface Design, and Group Dynamics (3)
- ENSC 406 Engineering Ethics, Law, and Professional Practice (2)
- ENSC 410 The Business of Engineering (3) or ENSC 411 The Business of Entrepreneurial Engineering (4)
- ENSC 429 Digital Signal Processing (4)
- ENSC 440 Capstone Engineering Science Project (3)
- ENSC 450 VLSI Systems Design (4) or ENSC 452 Advanced Digital System Design (4)
- MACM 201 Discrete Mathematics II (3)
- MACM 316 Numerical Analysis I (3)
- MATH 151 Calculus I (3)*
- MATH 152 Calculus II (3)
- MATH 232 Applied Linear Algebra (3)

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

- MATH 251 Calculus III (3)
- MATH 310 Introduction to Ordinary Differential Equations (3)
- *PHYS 120 Mechanics and Modern Physics (3)*
- *PHYS 121 Optics, Electricity and Magnetism (3)*
- **or MATH 150 Calculus I with Review if you do not meet the MATH 151 prerequisites*

Elective Course Requirements

We are moving the description of Engineering Science and Design electives from the final section of the calendar and replacing the section on Engineering Science Electives as all of the electives in the new curriculum will be Engineering Science and Design Electives (as opposed to just ENSC electives) to increase the flexibility in the program. We have also reduced the number of science electives from two to one course as we are still able to meet the Canadian Engineering Accreditation Board Requirements while reducing our students' workload.

~~Engineering Science Elective Courses~~	*Engineering Science & Design Elective Courses*
~~As well, students must complete two of~~	*Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.*
~~ENSC 424 - Multimedia Communications Engineering (4)~~	
~~ENSC 425 - Electronic System Design (4)~~	
~~ENSC 426 - High Frequency Electronics (4)~~	
~~ENSC 427 - Communication Networks (4)~~	
~~ENSC 428 - Digital Communications (4)~~	
~~ENSC 429 - Digital Signal Processing (4)~~	
~~ENSC 452 - Advanced Digital System Design (4)~~	
~~ENSC 472 - Rehabilitation Engineering and Assistive Devices (4)~~	
~~ENSC 474 - Digital/Medical Image Processing (4)~~	
~~ENSC 476 - Biophotonics and Microscopy Techniques (4)~~	*Engineering Design requires students to demonstrate an ability to design solutions for complex, open- ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.*
~~ENSC 481 - Designing for Reliability (4)~~	
~~ENSC 483 - Modern Control Systems (4)~~	
~~ENSC 488 - Introduction to Robotics (4)~~	
~~ENSC 489 - Computer Aided Design and Manufacturing (4)~~	
~~ENSC 495 - Introduction to Microelectronic Fabrication (4)~~	
~~Special topics courses in the 400 division that have been approved by the undergraduate curriculum committee chair and the director can be counted here. With permission of the undergraduate curriculum committee chair, students may replace one engineering science elective with an engineering science directed studies course or a special project laboratory course. Such replacements for an engi-~~	*Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have prerequisites not required for your option; these prerequisites would still need to be taken in order to enrol in the elective. Students interested in taking*

Science Elective Courses

Students must also complete ~~two~~ science elective course~~s~~ selected from a pre-approved science electives list that is available
at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/general-requirements/science-electives.html

<skip down to…>

Elective Courses

In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.

~~Engineering Science and Design (ESD) Electives~~

~~Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.~~

~~Engineering Design requires students to demonstrate an ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.~~

~~Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre-requisites would still need to be taken in order to enrol in the elective.~~

~~Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.~~

an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Students in the Computer Engineering Option must complete a minimum of 12 units from the engineering science & design elective course list at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/computer/curriculum-revised.html. As part of the required 12 units, students must complete one course set from the constrained elective list. Students may take a maximum of two 300-level ESD electives.

Science Elective Courses

Students must also complete *one* science elective *course* selected from a pre-approved science electives list that is available
at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/general-requirements/science-electives.html

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Elective Courses

In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.

Changes to the Engineering Science Major, Electronics Engineering Option

The changes to the engineering science major, electronics engineering option course sequence reflect the following updates. 1) ENSC 100 has been renumbered as ENSC 100W as all of our students are required to take the W version of the course to meet WQB requirements for graduation. 2) ENSC 201 has been renumbered as ENSC 410 to reflect that it is in fact a fourth year course. We have also added ENSC 411 as an alternative to ENSC 410 as this option has existed for some time but has never been clearly stated. 3) ENSC 224 has been renumbered as ENSC 324 to reflect that it is in fact a third year course. 4) The following courses have been removed from the program: ENSC 304 and ENSC 305W as they will no longer be offered (having been replaced by ENSC 405W); ENSC 330 as the course will no longer be offered; and MACM 316 is no longer a required course but is now an elective. 5) The number of credit hours in the following courses has been changed: ENSC 220 has had the number of credit hours increased to correctly reflect the lab component of the course; ENSC 440 has had the number of credit hours reduced as we have created a new course (ENSC 405W) as a prerequisite to replace ENSC 304 and ENSC 305W with an increased number of credit hours. 6) ENSC 405W will now be our upper division W course for the program and the prerequisite in a mandatory two-course sequence for our capstone project course, ENSC 405W-ENSC440. 7) Furthermore, we are now only listing our preferred physics course sequence for our program (e.g. PHYS 120 and PHYS 121) Although we will still recognize the other sequences for transfer students, we prefer our students to take the desired course sequence. We have done the same thing with MATH 151, now clearly listing MATH 150 as an acceptable alternative instead of a preference. 8) ENSC 425 and ENSC 426 have both been added as core courses to increase the unique curriculum content of the electronics option. For similar reasons, electronics students will also be required to take either ENSC 427 or ENSC 428. Finally, we have rewritten the Core Course Requirements introduction to indicate that students must obtain prior approval to replace any of the required courses for their option curriculum with a substitution- independent of whether the APR check recognizes that they are equivalent.

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 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)

Core Course Requirements

The following core courses are required for the Engineering Science Major in Electronics Engineering and cannot be substituted for "equivalent" courses in other areas without prior approval by the School. 'Equivalent' courses taken without prior approval will not be applied to graduation requirements. Students should consult an academic advisor within their program for details on obtaining permission.

- CHEM 121 General Chemistry and Laboratory I (4)
- CMPT 128 Introduction to Computing Science and Programming for Engineers (3)
- ECON 103 Principles of Microeconomics

- ~~ENSC 201 The Business of Engineering (3)~~
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (~~3~~)*
- ~~ENSC 224 Electronic Devices (3)~~
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ~~ENSC 304 Human Factors and Usability Engineering (1)~~
- ~~ENSC 305 Project Documentation and Team Dynamics (1)~~
- ENSC 320 Electric Circuits II (4)
- ENSC 325 Microelectronics II (4)
- ENSC 327 Communication Systems (4)
- ~~ENSC 330 Engineering Materials (4)~~
- ENSC 350 Digital Systems Design (4)
- ENSC 351 Embedded and Real Time System Software (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~~

- (4)
- *ENSC 100W Engineering Technology and Society (3)*
- ENSC 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (4)*
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 320 Electric Circuits II (4)
- *ENSC 324 Electronic Devices (3)*
- ENSC 325 Microelectronics II (4)
- ENSC 327 Communication Systems (4)
- ENSC 350 Digital Systems Design (4)
- ENSC 351 Embedded and Real Time System Software (4)
- ENSC 380 Linear Systems (3)
- ENSC 383 Feedback Control Systems (4)
- *ENSC 405W Project Documentation, User Interface Design, and Group Dynamics (3)*
- ENSC 406 Engineering Ethics, Law, and Professional Practice (2)
- *ENSC 410 The Business of Engineering (3) or ENSC 411 The Business of Entrepreneurial Engineering (4)*
- *ENSC 425 Electronic System Design (4)*
- *ENSC 426 High Frequency Electronics (4)*
- *ENSC 427 Communication Networks (4) or ENSC 428 Data Communications (4)*
- *ENSC 440 Capstone Engineering Science Project (3)*
- *MATH 151 Calculus I (3)**
- MATH 152 Calculus II (3)
- MATH 232 Applied Linear Algebra (3)
- MATH 251 Calculus III (3)
- MATH 254 Vector and Complex Analysis

~~Magnetism * (4)~~
- PHYS 321 Intermediate Electricity and Magnetism (3)
  - PHYS 421 Electromagnetic Waves (3)

for Applied Sciences (3)
- MATH 310 Introduction to Ordinary Differential Equations (3)
- ***PHYS 120 Mechanics and Modern Physics (3)***
- ***PHYS 121 Optics, Electricity and Magnetism (3)***
- PHYS 321 Intermediate Electricity and Magnetism (3)
- PHYS 421 Electromagnetic Waves (3)

*or MATH 150 Calculus I with Review if you do not meet the MATH 151 prerequisites

Elective Course Requirements

We are replacing the section on Engineering Science Electives as all of the electives in the new curriculum will be Engineering Science and Design Electives (as opposed to just ENSC electives) to increase the flexibility in the program.

Engineering Science Elective Courses

As well, students must complete five of

~~ENSC 424 - Multimedia Communications Engineering (4)~~
~~ENSC 425 - Electronic System Design (4)~~
~~ENSC 426 - High Frequency Electronics (4)~~
~~ENSC 427 - Communication Networks (4)~~
~~ENSC 428 - Digital Communications (4)~~
~~ENSC 429 - Digital Signal Processing (4)~~
~~ENSC 450 - VLSI Systems Design (4)~~
~~ENSC 452 - Advanced Digital System Design (4)~~
~~ENSC 472 - Rehabilitation Engineering and Assistive Devices (4)~~
~~ENSC 474 - Digital/Medical Image Processing (4)~~
~~ENSC 476 - Biophotonics and Microscopy Techniques (4)~~
~~ENSC 481 - Designing for Reliability (4)~~
~~ENSC 483 - Modern Control Systems (4)~~
~~ENSC 488 - Introduction to Robotics (4)~~
~~ENSC 489 - Computer Aided Design and Manufacturing (4)~~
~~ENSC 495 - Introduction to Microelectronic Fabrication (4)~~

~~Special topics courses in the 400 division that have been approved by the undergraduate curriculum committee chair and the director can be counted here. With permission of the undergraduate curriculum committee chair, students may replace one engineering science elective with an engineering science directed studies course or a special project laboratory course. Such replacements for an engineering science elective must have four units and be 400 division courses.~~

~~Science Elective Course~~

~~Students must also complete one science elective course selected from a pre-approved science electives list that is available at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/general-requirements/science-electives.html~~

Engineering Science & Design Elective Courses

Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.

Engineering Design requires students to demonstrate an ability to design solutions for complex, open- ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre- requisites would still need to be taken in order to enrol in the elective. Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Students in the Electronics Option must complete a minimum of 12 units from the engineering science & design elective course list, only one of which can be at the 300 level. The remaining engineering science and design units can be fulfilled using courses as specified at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/electronics/curriculum-

	revised.html.

Changes to the Engineering Science Major, Systems Option

The changes to the engineering science major, systems option course sequence reflect the following updates. 1) ENSC 100 has been renumbered as ENSC 100W as all of our students are required to take the W version of the course to meet WQB requirements for graduation. 2) ENSC 201 has been renumbered as ENSC 410 to reflect that it is in fact a fourth year course. We have also added ENSC 411 as an alternative to ENSC 410 as this option has existed for some time but has never been clearly stated. 3) ENSC 230 has been renumbered as ENSC 386 to reflect the correct course sequencing as a third year course. 4) ENSC 281 has been added to the curriculum and subsequently renumbered as ENSC 385 to reflect the correct course sequencing as it will be a third year course. 5) The following courses have been removed from the program: ENSC 304 and ENSC 305W as they will no longer be offered (having been replaced by ENSC 405W); ENSC 330, ENSC 483, ENSC 489, and ENSC 325 as they will no longer be mandatory for the systems option. 6) The number of credit hours in the following courses have been changed: ENSC 220 has had the number of credit hours increased to correctly reflect the lab component of the course; ENSC 440 has had the number of credit hours reduced as we have created a new course (ENSC 405W) as a prerequisite to replace ENSC 304 and ENSC 305W with an increased number of credit hours. 6) ENSC 405W will now be our upper division W course for the program and the prerequisite in a mandatory two-course sequence for our capstone project course ENSC405W-ENSC440. 7) Furthermore, we are now only listing our preferred physics course sequence for our program (e.g. PHYS 120 and PHYS 121) Although we will still recognize the other sequences for transfer students, we prefer our students to take the desired course sequence. We have done the same thing with MATH 151, now clearly listing MATH 150 as an acceptable alternative instead of a preference. 8) The recently created ENSC 482 has been added as a mandatory course to replace ENSC 483 and ENSC 489. ENSC 350 has also been added as core content to increase the digital content of the program. Finally, we have rewritten the Core Course Requirements introduction to indicate that students must obtain prior approval to replace any of the required courses for their option curriculum with a substitution-independent of whether the APR check recognizes that they are equivalent.

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 105W Process, Form and Convention in Professional Genres (3)

Core Course Requirements

The following core courses are required for the Engineering Science Major in Systems Engineering and cannot be substituted for "equivalent" courses in other areas without prior approval by the School. 'Equivalent' courses taken without prior approval will not be applied to graduation requirements. Students should consult an academic advisor within their program for details on obtaining permission.

- CHEM 121 General Chemistry and Laboratory I (4)
- CMPT 128 Introduction to Computing Science and Programming for Engineers

- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ~~ENSC 201 The Business of Engineering (3)~~
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (3)*
- ENSC 225 Microelectronics I (4)
- ~~ENSC 230 Introduction to Mechanical Design (4)~~
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ~~ENSC 304 Human Factors and Usability Engineering (1)~~
- ~~ENSC 305 Project Documentation and Team Dynamics (1)~~
- ENSC 320 Electric Circuits II (4)
- ~~ENSC 325 Microelectronics II (4)~~
- ~~ENSC 330 Engineering Materials (4)~~
- ENSC 351 Embedded and Real Time System Software (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)

- (3)
- CMPT 225 Data Structures and Programming (3)
- ECON 103 Principles of Microeconomics (4)
- *ENSC 100W Engineering Technology and Society (3)*
- ENSC 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (4)*
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 320 Electric Circuits II (4)
- *ENSC 350 Digital Systems Design (4)*
- ENSC 351 Embedded and Real Time System Software (4)
- ENSC 380 Linear Systems (3)
- ENSC 383 Feedback Control Systems (4)
- *ENSC 385 Statics and Strength of Materials (3)*
- *ENSC 386 Introduction to Mechanical Design (4)*
- ENSC 387 Introduction to Electro-Mechanical Sensors and Actuators (4)
- *ENSC 405W Project Documentation, User Interface Design, and Group Dynamics (3)*
- ENSC 406 Engineering Ethics, Law, and Professional Practice (2)
- *ENSC 410 The Business of Engineering (3) or ENSC 411 The Business of Entrepreneurial Engineering (4)*
- *ENSC 440 Capstone Engineering Science Project (3)*
- *ENSC 482 Introduction to Analytical Decision Making (4)*
- ENSC 488 Introduction to Robotics (4)

- 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)

- MACM 316 Numerical Analysis I (3)
- *MATH 151 Calculus I (3)**
- 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)*
- *PHYS 121 Optics, Electricity and Magnetism (3)*
- PHYS 221 Electromagnetics (3)

or MATH 150 Calculus I with Review if you do not meet the MATH 151 prerequisites

Elective Course Requirements

We are replacing the section on Engineering Science Electives as all of the electives in the new curriculum will be Engineering Science and Design Electives (as opposed to just ENSC electives) to increase the flexibility in the program.

Engineering Science Elective Courses

As well, students must complete two of

ENSC 424 - Multimedia Communications Engineering (4)
ENSC 425 - Electronic System Design (4)
ENSC 426 - High Frequency Electronics (4)
ENSC 427 - Communication Networks (4)
ENSC 428 - Digital Communications (4)
ENSC 429 - Digital Signal Processing (4)
ENSC 450 - VLSI Systems Design (4)
ENSC 452 - Advanced Digital System Design (4)
ENSC 472 - Rehabilitation Engineering and Assistive Devices (4)
ENSC 474 - Digital/Medical Image Processing (4)
ENSC 476 - Biophotonics and Microscopy Techniques (4)
ENSC 481 - Designing for Reliability (4)
ENSC 495 - Introduction to Microelectronic Fabrication (4)

Special topics courses in the 400 division that have been approved by the undergraduate curriculum committee chair and the director can be counted here. With permission of the undergraduate curriculum committee chair, students may replace one engineering science elective with an engineering science directed studies course or a special project laboratory course. Such replacements for an engineering science elective must have four units and be 400 division courses.

Science Elective Courses

Students must also complete one science elective course selected from a pre-approved science electives list that is available
at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/general-requirements/science-electives.html

Engineering Science & Design Elective Courses

Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.

Engineering Design requires students to demonstrate an ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre-requisites would still need to be taken in order to enrol in the elective. Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Students in the Systems Option must complete a minimum of 15 units from the engineering science & design elective course list at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/systems/curriculum-revised.html. As part of the required 15 units, students must complete one course from the constrained elective list.

Changes to Engineering Science Honours, Biomedical Engineering Option

The changes to the engineering science honours, biomedical engineering option course sequence reflect the following updates. 1) ENSC 100 has been renumbered as ENSC 100W as all of our students are required to take the W version of the course to meet WQB requirements for graduation. 2) ECON 103 has been added back into the curriculum, as it should not have been removed due to our accreditation board's economics requirement. 3) ENSC 201 has been renumbered as ENSC 410 to reflect that it is in fact a fourth year course. We have also added ENSC 411 as an alternative to ENSC 410 as this option has existed for some time but has never been clearly stated. 4) ENSC 372 has been renumbered to ENSC 475 to reflect the correct course sequencing as it will be a fourth year course. 5) The following courses have been removed from the program: ENSC 304 and ENSC 305W as they will no longer be offered (having been replaced by ENSC 405W); CMPT 225, ENSC 350 and MACM 316 will no longer be a required course for the biomedical option; ENSC 330 as the course will no longer be offered. 6) The number of credit hours in the following courses have been changed: ENSC 220 has had the number of credit hours increased to correctly reflect the lab component of the course; ENSC 440 has had the number of credit hours reduced as we have created a new course (ENSC 405W) as a prerequisite to replace ENSC 304 and ENSC 305W with an increased number of credit hours. 7) ENSC 405W will now be our upper division W course for the program and the prerequisite in a mandatory two-course sequence for our capstone project course ENSC 405W-ENSC440. 8) Furthermore, we are now only listing our preferred physics course sequence for our program (e.g. PHYS 120 and PHYS 121) Although we will still recognize the other sequences for transfer students, we prefer our students to take the desired course sequence. We have done the same thing with MATH 151, now clearly listing MATH 150 as an acceptable alternative instead of a preference. 9) Finally, ENSC 327 and 351 have also been added to provide increased opportunities to work on communications systems and embedded software design for biomedical students. ENSC 472 or ENSC 476, and ENSC 474 have also been added to the curriculum as required courses as part of the unique courses mandatory to the biomedical option. 10) Finally, we have rewritten the Core Course Requirements introduction to indicate that students must obtain prior approval to replace any of the required courses for their option curriculum with a substitution- independent of whether the APR check recognizes that they are equivalent.

Current	Proposed

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

Core Course Requirements

The following core courses are required by the Engineering Science Honours program in Biomedical Engineering and cannot be substituted for "equivalent" courses in other areas without prior approval by the School. 'Equivalent' courses taken without prior approval will not be applied to graduation requirements. Students should consult an academic advisor within their program for details on obtaining permission.

- CHEM 121 General Chemistry and Laboratory I (4)

- Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ~~ENSC 201 The Business of Engineering (3)~~
- ENSC 204 Graphical Communication for Engineering (1)
- **ENSC 220 Electric Circuits I (3)**
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ~~ENSC 304 Human Factors and Usability Engineering (1)~~
- ~~ENSC 305 Project Documentation and Team Dynamics (1)~~
- ENSC 320 Electric Circuits II (4)
- ~~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)**
- BPK 201 Biomechanics (3)
- BPK 208 Introduction to Physiological Systems (3)
- BPK 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)~~

- CHEM 180 The Chemistry of Life (3)
- CMPT 128 Introduction to Computing Science and Programming for Engineers (3)
- *ECON 103 Principles of Microeconomics (4)*
- **ENSC 100W Engineering Technology and Society (3)**
- ENSC 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 204 Graphical Communication for Engineering (1)
- **ENSC 220 Electric Circuits I (4)**
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 320 Electric Circuits II (4)
- *ENSC 327 Communication Systems (4)*
- *ENSC 351 Embedded and Real Time System Software (4)*
- ENSC 370 Biomedical Engineering Directions (3)
- ENSC 380 Linear Systems (3)
- ENSC 383 Feedback Control Systems (4)
- *ENSC 405W Project Documentation, User Interface Design, and Group Dynamics (3)*
- ENSC 406 Engineering Ethics, Law, and Professional Practice (2)
- *ENSC 410 The Business of Engineering (3) or ENSC 411 The Business of Entrepreneurial Engineering (4)*
- **ENSC 440 Capstone Engineering Science Project (3)**
- *ENSC 472 Orthopaedic and Rehabilitation Engineering (4) or ENSC 476 Biophotonics (4)*
- *ENSC 474 Digital/Medical Image Processing (4)*
- *ENSC 475 Biomedical Instrumentation (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)

*or any B-Soc course

- ENSC 498 Engineering Science Thesis Proposal (3)
- ENSC 499 Engineering Science Undergraduate Thesis (9)
- *GERO 300 Introduction to Gerontology (3)**
- BPK 201 Biomechanics (3)
- BPK 208 Introduction to Physiological Systems (3)
- ▲ BPK 308 Experiments and Models in Systems Physiology (3)
- ▲ *MATH 151 Calculus I (3)***
- 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)*
- ▲ *PHYS 121 Optics, Electricity and Magnetism (3)*
- PHYS 321 Intermediate Electricity and Magnetism (3)

*or any B-Soc course

**or MATH 150 Calculus I with Review if you do not meet the MATH 151 prerequisites

Elective Course Requirements

We are replacing the section on Engineering Science Electives as all of the electives in the new curriculum will be Engineering Science and Design Electives (as opposed to just ENSC electives) to increase the flexibility in the program.

Engineering Science & Design Elective Courses

Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.

Engineering Design requires students to demonstrate an ability to design solutions for complex, open- ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre- requisites would still need to be taken in order to enrol in the elective. Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Students in the Biomedical Engineering Op-tion must complete a minimum of 8 units from the engineering science & design elec-tive course list available at http://www.sfu.ca/engineering/undergraduat e_students/academic-programs/biomedical/curriculum-revised.html.

Changes to Engineering Science Honours, Computer Engineering Option

The changes to the engineering science honours, computer engineering option course sequence reflect the following updates. 1) ENSC 100 has been renumbered as ENSC 100W as all of our students are required to take the W version of the course to meet WQB requirements for graduation. 2) ENSC 201 has been renumbered as ENSC 410 to reflect that it is in fact a fourth year course. We have also added ENSC 411 as an alternative to ENSC 410 as this option has existed for some time but has never been clearly stated. 3) ENSC 224 has been renumbered as ENSC 324 to reflect that it is in fact a third year course. 4) The following courses have been removed from the program: ENSC 304 and ENSC 305W as they will no longer be offered, (having been replaced by ENSC 405W); and ENSC 325 and 383 as they have both been changed from mandatory to elective courses. 5) The number of credit hours in the following courses has been changed: ENSC 220 has had the number of credit hours increased to correctly reflect the lab component of the course; ENSC 440 has had the number of credit hours reduced as we have created a new course (ENSC 405W) as a prerequisite to replace ENSC 304 and ENSC 305W with an increased number of credit hours. 6) ENSC 405W will now be our upper division W course for the program and the prerequisite in a mandatory two-course sequence for our capstone project course ENSC 405W-ENSC440. 7) Furthermore, we are now only listing our preferred physics course sequence for our program (e.g. PHYS 120 and PHYS 121) Although we will still recognize the other sequences for transfer students, we prefer our students to take the desired course sequence. We have done the same thing with MATH 151, now clearly listing MATH 150 as an acceptable alternative instead of a preference. 8) Finally, we have added ENSC 429 as a required course for the computer curriculum as DSP is generally required in modern employment. We have now also listed that students can take either ENSC 450 or ENSC 452 as an upper division core course to increase the flexibility in the program for both students and course scheduling. Finally, we have rewritten the Core Course Requirements introduction to indicate that students must obtain prior approval to replace any of the required courses for their option curriculum with a substitution- independent of whether the APR check recognizes that they are equivalent.

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 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics

Core Course Requirements

The following core courses are required for the Engineering Science Honours program in Computer Engineering and cannot be substituted for "equivalent" courses in other areas without prior approval by the School. 'Equivalent' courses taken without prior approval will not be applied to graduation requirements. Students should consult an academic advisor within their program for details on obtaining permission.

- 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)

- Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ~~ENSC 201 The Business of Engineering (3)~~
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (3)*
- ~~ENSC 224 Electronic Devices (3)~~
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ~~ENSC 304 Human Factors and Usability Engineering (1)~~
- ~~ENSC 305 Project Documentation and Team Dynamics (1)~~
- ENSC 320 Electric Circuits II (4)
- ~~ENSC 325 Microelectronics II (4)~~
- ENSC 327 Communication Systems (4)
- ENSC 350 Digital Systems Design (4)
- ENSC 351 Embedded and Real Time System Software (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 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~~

- CMPT 275 Software Engineering I (4)
- CMPT 300 Operating Systems I (3)
- ECON 103 Principles of Microeconomics (4)
- *ENSC 100W Engineering Technology and Society (3)*
- ENSC 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (4)*
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 320 Electric Circuits II (4)
- *ENSC 324 Electronic Devices (3)*
- ENSC 327 Communication Systems (4)
- ENSC 350 Digital Systems Design (4)
- ENSC 351 Embedded and Real Time System Software (4)
- ENSC 380 Linear Systems (3)
- *ENSC 405W Project Documentation, User Interface Design, and Group Dynamics (3)*
- ENSC 406 Engineering Ethics, Law, and Professional Practice (2)
- *ENSC 410 The Business of Engineering (3) or ENSC 411 The Business of Entrepreneurial Engineering (4)*
- *ENSC 429 Digital Signal Processing (4)*
- *ENSC 440 Capstone Engineering Science Project (3)*
- *ENSC 450 VLSI Systems Design (4) or ENSC 452 Advanced Digital System Design (4)*
- ENSC 498 Engineering Science Thesis Proposal (3)
- ENSC 499 Engineering Science Undergraduate Thesis (9)
- MACM 201 Discrete Mathematics II (3)
- MACM 316 Numerical Analysis I (3)

- ~~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)~~

- *MATH 151 Calculus I (3)**
- 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)*
- *PHYS 121 Optics, Electricity and Magnetism (3)*

*or MATH 150 Calculus I with Review if you do not meet the MATH 151 prerequisites

Elective Course Requirements

We are moving the description of Engineering Science and Design electives from the final section of the calendar and replacing the section on Engineering Science Electives as all of the electives in the new curriculum will be Engineering Science and Design Electives (as opposed to just ENSC electives) to increase the flexibility in the program. We have also reduced the number of science electives from two to one course as we are still able to meet the Canadian Engineering Accreditation Board Requirements while reducing our students' workload.

Engineering Science Elective Courses

As well, students must complete two of

ENSC 424 - Multimedia Communications Engineering (4)
ENSC 425 - Electronic System Design (4)
ENSC 426 - High Frequency Electronics (4)
ENSC 427 - Communication Networks (4)
ENSC 428 - Digital Communications (4)
ENSC 429 - Digital Signal Processing (4)
ENSC 452 - Advanced Digital System Design (4)
ENSC 472 - Rehabilitation Engineering and Assistive Devices (4)
ENSC 474 - Digital/Medical Image Processing (4)
ENSC 476 - Biophotonics and Microscopy Techniques (4)
ENSC 481 - Designing for Reliability (4)
ENSC 483 - Modern Control Systems (4)
ENSC 488 - Introduction to Robotics (4)
ENSC 489 - Computer Aided Design and Manufacturing (4)
ENSC 495 - Introduction to Microelectronic Fabrication (4)

Special topics courses in the 400 division that have been approved by the undergraduate curriculum committee chair and the director can be counted here. With permission of the undergraduate curriculum committee chair, students may replace one engineering science elective with an engineering science directed studies course or a special project laboratory course. Such replacements for an engineering science elective must have four units and be 400 division courses.

Science Elective Courses

Students must also complete ~~two~~ science elective course~~s~~ selected from a pre-approved science electives list that is available at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/general-requirements/science-electives.html

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Elective Courses

In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.

Engineering Science & Design Elective Courses

Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.

Engineering Design requires students to demonstrate an ability to design solutions for complex, open- ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre-requisites would still need to be taken in order to enrol in the elective. Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Students in the Computer Engineering Option must complete a minimum of 12 units from the engineering science & design elective course list at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/computer/curriculum-revised.html. As part of the required 12 units, students must complete one course set from the constrained elective list. Students may take a maximum of two 300-level ESD electives.

Engineering Science and Design (ESD) Electives

Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.

Engineering Design requires students to demonstrate an ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre-requisites would still need to be taken in order to enrol in the elective.

Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of

their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Science Elective Courses

Students must also complete *one* science elective *course* selected from a pre-approved science electives list that is available at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/general-requirements/science-electives.html

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Elective Courses

In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.

Changes to Engineering Science Honours, Electronics Engineering Option

The changes to the engineering science honours, electronics engineering option course sequence reflect the following updates. 1) ENSC 100 has been renumbered as ENSC 100W as all of our students are required to take the W version of the course to meet WQB requirements for graduation. 2) ENSC 201 has been renumbered as ENSC 410 to reflect that it is in fact a fourth year course. We have also added ENSC 411 as an alternative to ENSC 410 as this option has existed for some time but has never been clearly stated. 3) ENSC 224 has been renumbered as ENSC 324 to reflect that it is in fact a third year course. 4) The following courses have been removed from the program: ENSC 304 and ENSC 305W as they will no longer be offered (having been replaced by ENSC 405W); ENSC. 330 as the course will no longer be offered. Also, MACM 316 has been removed as a required course and made an elective. 5) The number of credit hours in the following courses has been changed: ENSC 220 has had the number of credit hours increased to correctly reflect the lab component of the course; ENSC 440 has had the number of credit hours reduced as we have created a new course (ENSC 405W) as a prerequisite to replace ENSC 304 and ENSC 305W with an increased number of credit hours. 6) ENSC 405W will now be our upper division W course for the program and the prerequisite in a mandatory two-course sequence for our capstone project course ENSC405W-ENSC440. 7) Furthermore, we are now only listing our preferred physics course sequence for our program (e.g. PHYS 120 and PHYS 121) Although we will still recognize the other sequences for transfer students, we prefer our students to take the desired course sequence. We have done the same thing with MATH 151, now clearly listing MATH 150 as an acceptable alternative instead of a preference. 8) ENSC 425 and ENSC 426 have both been added as core courses to increase the unique curriculum content of the electronics option. For similar reasons, electronics students will also be required to take either ENSC 427 or ENSC 428. Finally, we have rewritten the Core Course Requirements introduction to indicate that students must obtain prior approval to replace any of the required courses for their option curriculum with a substitution- independent of whether the APR check recognizes that they are equivalent.

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 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques (1)

Core Course Requirements

The following core courses are required for the Engineering Science Honours program in Electronics Engineering and cannot be substituted for "equivalent" courses in other areas without prior approval by the School. 'Equivalent' courses taken without prior approval will not be applied to graduation requirements. Students should consult an academic advisor within their program for details on obtaining permission.

- CHEM 121 General Chemistry and Laboratory I (4)
- CMPT 128 Introduction to Computing Science and Programming for Engineers (3)
- ECON 103 Principles of Microeconomics

Left column:

- ENSC 180 Introduction to Engineering Analysis (3)
- ~~ENSC 201 The Business of Engineering (3)~~
- ENSC 204 Graphical Communication for Engineering (1)
- **ENSC 220 Electric Circuits I (3)**
- ~~ENSC 224 Electronic Devices (3)~~
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ~~ENSC 304 Human Factors and Usability Engineering (1)~~
- ~~ENSC 305 Project Documentation and Team Dynamics (1)~~
- ENSC 320 Electric Circuits II (4)
- ENSC 325 Microelectronics II (4)
- ENSC 327 Communication Systems (4)
- ~~ENSC 330 Engineering Materials (4)~~
- ENSC 350 Digital Systems Design (4)
- ENSC 351 Embedded and Real Time System Software (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*~~

Right column:

- (4)
- **ENSC 100W Engineering Technology and Society (3)**
- ENSC 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 204 Graphical Communication for Engineering (1)
- **ENSC 220 Electric Circuits I (4)**
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 320 Electric Circuits II (4)
- *ENSC 324 Electronic Devices (3)*
- ENSC 325 Microelectronics II (4)
- ENSC 327 Communication Systems (4)
- ENSC 350 Digital Systems Design (4)
- ENSC 351 Embedded and Real Time System Software (4)
- ENSC 380 Linear Systems (3)
- ENSC 383 Feedback Control Systems (4)
- *ENSC 405W Project Documentation, User Interface Design, and Group Dynamics (3)*
- ENSC 406 Engineering Ethics, Law, and Professional Practice (2)
- *ENSC 410 The Business of Engineering (3) or ENSC 411 The Business of Entrepreneurial Engineering (4)*
- *ENSC 425 Electronic System Design (4)*
- *ENSC 426 High Frequency Electronics (4)*
- *ENSC 427 Communication Networks (4) or ENSC 428 Data Communications (4)*
- **ENSC 440 Capstone Engineering Science Project (3)**
- ENSC 498 Engineering Science Thesis Proposal (3)
- ENSC 499 Engineering Science Undergraduate Thesis (9)
- *MATH 151 Calculus I (3)**
- MATH 152 Calculus II (3)

- ~~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)

- 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)**
- **PHYS 121 Optics, Electricity and Magnetism (3)**
- PHYS 321 Intermediate Electricity and Magnetism (3)
- PHYS 421 Electromagnetic Waves (3)

or MATH 150 Calculus I with Review if you do not meet the MATH 151 prerequisites

Elective Course Requirements

We are replacing the section on Engineering Science Electives as all of the electives in the new curriculum will be Engineering Science and Design Electives (as opposed to just ENSC electives) to increase the flexibility in the program.

Engineering Science & Design Elective Courses

Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.

Engineering Design requires students to demonstrate an ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre-requisites would still need to be taken in order to enrol in the elective. Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Students in the Electronics Option must complete a minimum of 12 units from the engineering science & design elective course list, only one of which can be at the 300 level. The remaining engineering science and design units can be fulfilled using courses as specified at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/electronics/curriculum-revised.html.

Changes to Engineering Science Honours, Engineering Physics Option

The changes to the engineering science honours, engineering physics option course sequence reflect the following updates. 1) ENSC 100 has been renumbered as ENSC 100W as all of our students are required to take the W version of the course to meet WQB requirements for graduation. 2) ENSC 201 has been renumbered as ENSC 410 to reflect that it is in fact a fourth year course. We have also added ENSC 411 as an alternative to ENSC 410 as this option has existed for some time but has never been clearly stated. 3) PHYS 365 has been replaced by ENSC 324, and PHYS 332 and PHYS 455 have been replaced by ENSC 470. 4) The following courses have been removed from the program: ENSC 304 and ENSC 305W as they will no longer be offered (having been replaced by ENSC 405W); ENSC 327 has been removed as a required course and made an elective. 5) The number of credit hours in the following courses has been changed: ENSC 220 has had the number of credit hours increased to correctly reflect the lab component of the course; ENSC 440 has had the number of credit hours reduced as we have created a new course (ENSC 405W) as a prerequisite to replace ENSC 304 and ENSC 305W with an increased number of credit hours. 6) ENSC 405W will now be our upper division W course for the program and the prerequisite in a mandatory two-course sequence for our capstone project course ENSC 405W-ENSC440. 7) Furthermore, we are now only listing our preferred physics course sequence for our program (e.g. PHYS 120 and PHYS 121) Although we will still recognize the other sequences for transfer students, we prefer our students to take the desired course sequence. We have done the same thing with MATH 151, now clearly listing MATH 150 as an acceptable alternative instead of a preference. 8) ENSC 470 and ENSC 495 have been added as required courses as part of the definition of unique mandatory courses for the engineering physics option. Finally, we have rewritten the Core Course Requirements introduction to indicate that students must obtain prior approval to replace any of the required courses for their option curriculum with a substitution- independent of whether the APR check recognizes that they are equivalent.

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 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- *ENSC 201 The Business of Engineering*

Core Course Requirements

The following core courses are required for the Engineering Science Honours program in Engineering Physics and cannot be substituted for "equivalent" courses in other areas without prior approval by the School. 'Equivalent' courses taken without prior approval will not be applied to graduation requirements. Students should consult an academic advisor within their program for details on obtaining permission.

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)

- *(3)*
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (3)*
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ~~ENSC 304 Human Factors and Usability Engineering (1)~~
- ~~ENSC 305 Project Documentation and Team Dynamics (1)~~
- ENSC 320 Electric Circuits II (4)
- ENSC 325 Microelectronics II (4)
- ~~ENSC 327 Communication Systems (4)~~
- ENSC 351 Embedded and Real Time System Software (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)
- *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)~~

- *ENSC 100W Engineering Technology and Society (3)*
- ENSC 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (4)*
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 320 Electric Circuits II (4)
- *ENSC 324 Electronic Devices (3)*
- ENSC 325 Microelectronics II (4)
- ENSC 351 Embedded and Real Time System Software (4)
- ENSC 380 Linear Systems (3)
- ENSC 383 Feedback Control Systems (4)
- *ENSC 405W Project Documentation, User Interface Design, and Group Dynamics (3)*
- ENSC 406 Engineering Ethics, Law, and Professional Practice (2)
- *ENSC 410 The Business of Engineering (3) or ENSC 411 The Business of Entrepreneurial Engineering (4)*
- *ENSC 440 Capstone Engineering Science Project (3)*
- *ENSC 470 Optical and Laser Engineering Applications (4)*
- *ENSC 495 Introduction to Microelectronic Fabrication (4)*
- ENSC 498 Engineering Science Thesis Proposal (3)
- ENSC 499 Engineering Science Undergraduate Thesis (9)
- *MATH 151 Calculus I (3)**
- MATH 152 Calculus II (3)
- MATH 232 Applied Linear Algebra (3) Proposal (3)
- MATH 151 Calculus I (3) or MATH 150 Calculus I with Review (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)~~

- 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)*
- *PHYS 121 Optics, Electricity and Magnetism (3)*
- PHYS 211 Intermediate Mechanics (3)
- PHYS 233 Physics Laboratory III (2)
- PHYS 321 Intermediate Electricity and Magnetism (3)
- PHYS 344 Thermal Physics (3)
- PHYS 384 Methods of Theoretical Physics I (3)
- PHYS 385 Quantum Mechanics I (3)
- PHYS 421 Electromagnetic Waves (3)

*or MATH 150 Calculus I with Review if you do not meet the MATH 151 prerequisites

Elective Course Requirements

We are replacing the section on Engineering Science Electives as all of the electives in the new curriculum will be Engineering Science and Design Electives (as opposed to just ENSC electives) to increase the flexibility in the program.

Physics Elective ~~Course~~

Engineering Science & Design Elective Courses

Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.

Engineering Design requires students to demonstrate an ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre-requisites would still need to be taken in order to enrol in the elective. Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Students in the Engineering Physics Option must complete a minimum of 8 units from the approved engineering science & design elective list in addition to their required physics electives below. Only one engineering science & design elective from the approved list can be at the 300 level. The approved engineering science and design electives for Engineering Physics can be found at
http://www.sfu.ca/engineering/undergraduate_students/academic-programs/physics/curriculum-revised.html.

Physics Electives

	In addition to the required physics courses and engineering science and design electives, students must also complete 3 physics electives. One physics elective must be a 400 division physics course.

Changes to Engineering Science Honours, Systems Option

The changes to the engineering science honours, systems option course sequence reflect the following updates. 1) ENSC 100 has been renumbered as ENSC 100W as all of our students are required to take the W version of the course to meet WQB requirements for graduation. 2) ENSC 201 has been renumbered as ENSC 410 to reflect that it is in fact a fourth year course. We have also added ENSC 411 as an alternative to ENSC 410 as this option has existed for some time but has never been clearly stated. 3) ENSC 230 has been renumbered as ENSC 386 to reflect the correct course sequencing as a third year course. 4) ENSC 281 has been added to the curriculum and subsequently renumbered as ENSC 385 to reflect the correct course sequencing as it will be a third year course. 5) The following courses have been removed from the program: ENSC 304 and ENSC 305W as they will no longer be offered (having been replaced by ENSC 405W), ENSC 330, ENSC 483, ENSC 489, and ENSC 325 as they will no longer be mandatory for the systems option. 6) The number of credit hours in the following courses has been changed: ENSC 220 has had the number of credit hours increased to correctly reflect the lab component of the course; ENSC 440 has had the number of credit hours reduced as we have created a new course (ENSC 405W) as a prerequisite to replace ENSC 304 and ENSC 305W with an increased number of credit hours. 7) ENSC 405W will now be our upper division W course for the program and the prerequisite in a mandatory two-course sequence for our capstone project course ENSC405W-ENSC440. 8) Furthermore, we are now only listing our preferred physics course sequence for our program (e.g. PHYS 120 and PHYS 121) Although we will still recognize the other sequences for transfer students, we prefer our students to take the desired course sequence. We have done the same thing with MATH 151, now clearly listing MATH 150 as an acceptable alternative instead of a preference. 9) The recently created ENSC 482 has been added as a mandatory course to replace ENSC 483 and ENSC 489. ENSC 350 has also been added as core content to increase the digital content of the program. Finally, we have rewritten the Core Course Requirements introduction to indicate that students must obtain prior approval to replace any of the required courses for their option curriculum with a substitution-independent of whether the APR check recognizes that they are equivalent.

Current

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

Proposed

Core Course Requirements

The following core courses are required for the Engineering Science Honours program in Systems Engineering and cannot be substituted for "equivalent" courses in other areas without prior approval by the School. 'Equivalent' courses taken without prior approval will not be applied to graduation requirements. Students should consult an academic advisor within their program for details on obtaining permission.

- CHEM 121 General Chemistry and Laboratory I (4)
- CMPT 128 Introduction to Computing Science and Programming for Engineers

Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments and Measurement Techniques (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ~~ENSC 201 The Business of Engineering (3)~~
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (3)*
- ENSC 225 Microelectronics I (4)
- ~~ENSC 230 Introduction to Mechanical Design (4)~~
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ~~ENSC 304 Human Factors and Usability Engineering (1)~~
- ~~ENSC 305 Project Documentation and Team Dynamics (1)~~
- ENSC 320 Electric Circuits II (4)
- ~~ENSC 325 Microelectronics II (4)~~
- ~~ENSC 330 Engineering Materials (4)~~
- ENSC 351 Embedded and Real Time System Software (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)~~
- ENSC 498 Engineering Science Thesis Proposal (3)
- ENSC 499 Engineering Science Undergraduate Thesis (9)
- 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)~~

(3)
- CMPT 225 Data Structures and Programming (3)
- ECON 103 Principles of Microeconomics (4)
- *ENSC 100W Engineering Technology and Society (3)*
- ENSC 105W Process, Form and Convention in Professional Genres (3)
- ENSC 120 Introduction to Electronics Laboratory Instruments (1)
- ENSC 180 Introduction to Engineering Analysis (3)
- ENSC 204 Graphical Communication for Engineering (1)
- *ENSC 220 Electric Circuits I (4)*
- ENSC 225 Microelectronics I (4)
- ENSC 251 Software Design & Analysis for Engineers (4)
- ENSC 252 Introduction to Digital Logic (4)
- ENSC 254 Introduction to Computer Organization (4)
- ENSC 280 Engineering Measurement and Data Analysis (3)
- ENSC 320 Electric Circuits II (4)
- *ENSC 350 Digital Systems Design (4)*
- ENSC 351 Embedded and Real Time System Software (4)
- ENSC 380 Linear Systems (3)
- ENSC 383 Feedback Control Systems (4)
- *ENSC 385 Statics and Strength of Materials (3)*
- *ENSC 386 Introduction to Mechanical Design (4)*
- ENSC 387 Introduction to Electro-Mechanical Sensors and Actuators (4)
- *ENSC 405W Project Documentation, User Interface Design, and Group Dynamics (3)*
- ENSC 406 Engineering Ethics, Law, and Professional Practice (2)
- *ENSC 410 The Business of Engineering (3) or ENSC 411 The Business of Entrepreneurial Engineering (4)*
- *ENSC 440 Capstone Engineering Science Project (3)*
- *ENSC 482 Introduction to Analytical Decision Making (4)*
- ENSC 488 Introduction to Robotics (4)
- ENSC 498 Engineering Science Thesis

- 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)
-

- Proposal (3)
- ENSC 499 Engineering Science Undergraduate Thesis (9)
- MACM 101 Discrete Mathematics I (3)
- MACM 316 Numerical Analysis I (3)
- *MATH 151 Calculus I (3)**
- 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)*
- *PHYS 121 Optics, Electricity and Magnetism (3)*
- PHYS 221 Electromagnetics (3)

**or MATH 150 Calculus I with Review if you do not meet the MATH 151 prerequisites*

Elective Course Requirements

We are replacing the section on Engineering Science Electives as all of the electives in the new curriculum will be Engineering Science and Design Electives (as opposed to just ENSC electives) to increase the flexibility in the program.

Engineering Science Elective Courses

As well, students must complete two of

ENSC 424 - Multimedia Communications Engineering (4)
ENSC 425 - Electronic System Design (4)
ENSC 426 - High Frequency Electronics (4)
ENSC 427 - Communication Networks (4)
ENSC 428 - Digital Communications (4)
ENSC 429 - Digital Signal Processing (4)
ENSC 450 - VLSI Systems Design (4)
ENSC 452 - Advanced Digital System Design (4)
ENSC 472 - Rehabilitation Engineering and Assistive Devices (4)
ENSC 474 - Digital/Medical Image Processing (4)
ENSC 476 - Biophotonics and Microscopy Techniques (4)
ENSC 481 - Designing for Reliability (4)
ENSC 495 - Introduction to Microelectronic Fabrication (4)

Special topics courses in the 400 division that have been approved by the undergraduate curriculum committee chair and the director can be counted here. With permission of the undergraduate curriculum committee chair, students may replace one engineering science elective with an engineering science directed studies course or a special project laboratory course. Such replacements for an engineering science elective must have four units and be 400 division courses.

Science Elective Course

Students must also complete one science elective course selected from a pre-approved science electives list that is available at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/general-requirements/science-electives.html

Physics Elective Course

Students must also complete one 400 division physics elective course.

Engineering Science & Design Elective Courses

Engineering Science and Design (ESD) Electives may be offered by departments other than the School of Engineering Science, but they must satisfy the Canadian Engineering Accreditation Board (CEAB) engineering science and engineering design requirements. Generally, Engineering Science has roots in mathematics and basic sciences, but carries knowledge further toward creative applications that could include simulation, experimental procedures, modelling and the development of mathematical or numerical techniques. Application to the identification and solution of practical engineering problems is stressed.

Engineering Design requires students to demonstrate an ability to design solutions for complex, open- ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Each option has a pre-approved list of electives that may include one or more pre-approved ESD electives. Note that these courses may have pre-requisites not required for your option; these pre-requisites would still need to be taken in order to enrol in the elective. Students interested in taking an ESD elective course that does not appear on this list should contact the Chair of their option/Undergraduate Curriculum Committee and obtain his/her approval in writing before proceeding with the course.

Students in the Systems Option must complete a minimum of 15 units from the engineering science & design elective course list at http://www.sfu.ca/engineering/undergraduate_students/academic-programs/systems/curriculum-revised.html. As part of the required 15 units, students must complete one course from the constrained elective list.

OFFICE OF THE DEAN
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MEMORANDUM

ATTENTION	Senate Committee on Undergraduate Studies	**DATE**	October 15, 2014
FROM	Ed Park, Associate Dean	**PAGES**	
RE:	Pre-requisite Changes - Oversight Correction		

The following changes have been approved by the FAS Undergraduate Curriculum Committee and are appended here for approval by SCUS and recommendation to Senate.

      1.)   School of Engineering Science
           a)   Pre-requisite Changes (Oversight Correction)
               i.   ENSC 327
               ii.   ENSC 328

Thank you,

Edward Park
Associate Dean

(EP/mt)

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 __ENSC 327__

TO
Course Subject/Number __ENSC 327__

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: ENSC 380 and STAT 270

PREREQUISITE

TO: (ENSC 380 or MSE 280) and ENSC 280. Students who completed STAT 270 prior to Spring 2015 may use STAT 270 instead of ENSC 280.

LEARNING OUTCOMES

RATIONALE

STAT 270 is being replaced by ENSC 280 in our curriculum so it needs to be added as a pre-requisite.

MSE's ENSC 380 equivalent (MSE 280) has also been added as an alternate pre-requisite.

Effective term and year
Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number __ENSC 328__

TO
Course Subject/Number __ENSC 328__

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: ENSC 380 and STAT 270. STAT 270 may be taken concurrently.

PREREQUISITE

TO: (ENSC 380 or MSE 280) and ENSC 280. ENSC 280 may be taken concurrently with ENSC 328. Students who completed STAT 270 prior to Spring 2015 may use STAT 270 instead of ENSC 280.

LEARNING OUTCOMES

RATIONALE

STAT 270 is being replaced with ENSC 280 in our curriculum so the pre-requisite needs to be revised accordingly.

MSE's ENSC 380 equivalent (MSE 280) has also been added as an alternate pre-requisite

Effective term and year   Summer 2015

SFU FACULTY OF APPLIED SCIENCES

OFFICE OF THE DEAN
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MEMORANDUM

ATTENTION	Senate Committee on Undergraduate Studies	**DATE**	October 15, 2014
FROM	Ed Park, Associate Dean	**PAGES**	
RE:	Curriculum Changes		

The following changes have been approved by the FAS Undergraduate Curriculum Committee and are appended here for approval by SCUS and recommendation to Senate.

1.) School of Computing Science
     a. Calendar Changes
         i. Removal of CMPT 250 as a Lower Division Requirement from the CS Major Program
         ii. Correction to the Depth Requirement for the CS Honours Program
         iii. Removal of Specialization Requirements from the Software Systems Major Program

     b. Course Description Changes
         i. CMPT 100
         ii. CMPT 120
         iii. CMPT 166

     c. Course Pre-requisite Changes
         i. CMPT 261
         ii. CMPT 340
         iii. CMPT 468

     d. Course Description and Pre-requisite Changes
         i. CMPT 170
         ii. CMPT 375

Thank you,

Edward Park
Associate Dean

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Revision to Computing Science Major Program

Faculty of Applied Sciences Curriculum Committee

John Edgar

October 2014

Description and Rationale

We propose the removal of CMPT 250 (Introduction to Computer Architecture) as a required course in the Lower Division Requirements of the CS Major program. The course will remain as an elective. This change relates to the addition of CMPT 127 to the lower division requirements as we wish to allow students to retain the current level of flexibility regarding elective courses.

Current	Proposed
Lower Division Requirements	**Lower Division Requirements**
Students must complete the courses listed below. It is suggested that students complete a recommended schedule of courses within the first two years.	Students must complete the courses listed below. It is suggested that students complete a recommended schedule of courses within the first two years.
Students complete all of	Students complete all of
CMPT 120 - Introduction to Computing Science and Programming I (3)	CMPT 120 - Introduction to Computing Science and Programming I (3)
CMPT 125 - Introduction to Computing Science and Programming II (3)	CMPT 125 - Introduction to Computing Science and Programming II (3)
CMPT 127 - Computing Laboratory (3)	CMPT 127 - Computing Laboratory (3)
CMPT 150 - Introduction to Computer Design (3)	CMPT 150 - Introduction to Computer Design (3)
CMPT 225 - Data Structures and Programming (3)	CMPT 225 - Data Structures and Programming (3)
~~CMPT 250 - Introduction to Computer Architecture (3)~~	CMPT 275 - Software Engineering I (4)
	MACM 101 - Discrete Mathematics I (3)

Revision to Computing Science Honours Program

Faculty of Applied Sciences Curriculum Committee

John Edgar

October 2014

Description and Rationale

We propose an amendment to the Depth Requirement of the CS Honours program to allow students to satisfy part of their depth requirement with third year courses. This change is to correct an error in the depth requirements that was introduced in the Fall 2010 Calendar.

Current	Proposed
Depth Requirement	Depth Requirement
~~Eighteen units of additional CMPT courses numbered CMPT 400 or above must be completed (excluding CMPT 415, 416 and 498, which may be included by special permission).~~	Eighteen units of additional CMPT courses numbered CMPT 300 or above must be completed, at least twelve of which must be numbered 400 or above.
~~These courses must include CMPT 405 and at least one other course in the theoretical computing science concentration. At least four of the courses must be numbered 400 or above.~~	These eighteen units must include CMPT 405; at least one other course in the theoretical computing science concentration; and, unless given special permission, cannot include CMPT 415, 416 and 498.
In addition, six units of research courses are required including both of	In addition, six units of research courses are required including both of
CMPT 415 - Special Research Projects (3) CMPT 416 - Special Research Projects (3)	CMPT 415 - Special Research Projects (3) CMPT 416 - Special Research Projects (3)
or	or

| CMPT 498 - Honors Research Project (6) | CMPT 498 - Honors Research Project (6) |

Revision to Software Systems Major Program

Faculty of Applied Sciences Curriculum Committee

John Edgar

October 2014

Description and Rationale

Removal of Specialization Requirement as it was included in error.

Current	Proposed (remove section)
## ~~Specialization Requirements~~ ~~Students are required to take a "specialization" consisting of nine additional CMPT or MACM credits at the 300- or 400- level. This specialization must be approved by the School. See a Faculty of Applied Sciences advisor for more information.~~ ## ~~Elective Courses~~ ~~In addition to the courses listed above, students should consult a Faculty of Applied Sciences advisor to plan the remaining required elective courses.~~	

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 100

TO
Course Subject/Number CMPT 100

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:

Introduction to the fundamentals of computer operation and computer programming. The use of software packages is emphasized, focusing on spreadsheets, databases, and presentation graphics. Techniques of solving problems using structured programs in a modern database programming environment are introduced. Students with credit for CMPT 101, 102, 103, 104, 120, 126 or 128 may not take this course for further credit.

DESCRIPTION
TO:

Introduction to the fundamentals of computer operation and computer programming. The use of software packages is emphasized, focusing on spreadsheets, databases, and presentation graphics. Techniques of solving problems using structured programs in a modern database programming environment are introduced. Students with credit for CMPT 101, 102, 103, 104, 120, 126, 128 or 130 may not take this course for further credit.

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

Change in description related to the introduction of CMPT 130 (the first programming course in the Software Systems program).

Effective term and year
Summer 2015

SFU

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 120_____

TO
Course Subject/Number __CMPT 120_____

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:

An elementary introduction to computing science and computer programming, suitable for students with little or no programming background. Students will learn fundamental concepts and terminology of computing science, acquire elementary skills for programming in a high-level language and be exposed to diverse fields within, and applications of computing science. Topics will include: pseudocode, data types and control structures, fundamental algorithms, computability and complexity, computer architecture, and history of computing science. Treatment is informal and programming is presented as a problem-solving tool. Students should consult with the self-evaluation on the School of Computing Science website to decide whether they should follow the CMPT 120/125 course sequence or enrol in CMPT 126. Students with credit for CMPT 102, 125, 126, 128 or CMPT 200 or higher may not take this course for further credit.

DESCRIPTION
TO:

An elementary introduction to computing science and computer programming, suitable for students with little or no programming background. Students will learn fundamental concepts and terminology of computing science, acquire elementary skills for programming in a high-level language and be exposed to diverse fields within, and applications of computing science. Topics will include: pseudocode, data types and control structures, fundamental algorithms, computability and complexity, computer architecture, and history of computing science. Treatment is informal and programming is presented as a problem-solving tool. Students with credit for CMPT 102, 125, 126, 128 or 130 may not take this course for further credit.

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: **TO:**

PREREQUISITE

LEARNING OUTCOMES

RATIONALE
Change in description related to the introduction of CMPT 130 (the first programming course in the Software Systems program).

Effective term and year
Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number _____ CMPT 166 _____

TO
Course Subject/Number _____ CMPT 166 _____

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:

An informal introduction to programming using examples drawn from animation and graphics. Fundamental programming language features are covered, including variables, expressions, statements, loops, functions, and objects. Class design, event-driven programming or other advanced programming techniques may be introduced as needed. No prior programming experience is assumed.

DESCRIPTION
TO:

An informal introduction to programming using examples drawn from animation and graphics. Fundamental programming language features are covered, including variables, expressions, statements, loops, functions, and objects. Class design, event-driven programming or other advanced programming techniques may be introduced as needed. No prior programming experience is assumed. Students with credit for CMPT 102, 125, 126, 128, or 130 may not take this course for further credit.

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

Change in description to include courses for which additional credit cannot be given which was omitted from the original.

Effective term and year
Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number __CMPT 261__

TO
Course Subject/Number __CMPT 261__

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: CMPT 125, 126, or 128. MATH 232.

PREREQUISITE

TO: Prerequisite: MATH 232 and one of CMPT 125, 126, 128 or 130.

LEARNING OUTCOMES

RATIONALE

Change in prerequisite related to the introduction of CMPT 130 (the first programming course in the Software Systems program).

Effective term and year
Summer 2015

NOVEMBER 2012

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 340__

TO
Course Subject/Number __CMPT 340__

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: Completion of 60 units including CMPT 125, 126 or 128 (or 102 with a grade of B or higher).

PREREQUISITE

TO: Prerequisite: Completion of 60 units including one of CMPT 125, 126,128, 135 or (102 with a grade of B or higher).

LEARNING OUTCOMES

RATIONALE

Change in description related to the introduction of CMPT 135 (the second programming course in the Software Systems program).

Effective term and year
Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number_____CMPT 468_____

TO
Course Subject/Number_____CMPT 468_____

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**.

PREREQUISITE

FROM: Prerequisite: MATH 152 and one of CMPT 125, 126 or 128 (or permission of instructor).

TO: Prerequisite: MATH 152 and one of CMPT 125, 126, 128, 135 or permission of instructor.

LEARNING OUTCOMES

RATIONALE

Change in prerequisite related to the introduction of CMPT 135 (the second programming course in the Software Systems program).

Effective term and year

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 170_____

TO
Course Subject/Number __CMPT 170_____

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:

An introduction to the creation of web pages, as well as interactive websites. Students will learn how to create web pages using current best practices. Creation of web-based application using a modern web application framework. Students with credit for CMPT 118 or CMPT 165 may not take this course for further credit.

DESCRIPTION
TO:

An introduction to the creation of web pages, as well as interactive websites. Students will learn how to create web pages using current best practices. Creation of web-based application using a modern web application framework. Students with credit for CMPT 118 or CMPT 165 may not take this course for further credit. Enrolling in CMPT 125 concurrently is highly recommended if students have only satisfied the CMPT 120 prerequisite.

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: CMPT 120 or 126 or 128. Enrolling in CMPT 125 concurrently is highly recommended if CMPT 126 or 128 has not already been completed.

PREREQUISITE

TO: Prerequisite: One of CMPT 120, (125 and 127), 126, 128 or 135.

LEARNING OUTCOMES

RATIONALE

Change in prerequisite related to the introduction of CMPT 135 (the second programming course in the Software Systems program), and CMPT 127 (a programming lab course tht is a co-requisite with CMPT 125).

Effective term and year
Summer 2015

EXISTING COURSE, CHANGES RECOMMENDED

Please check appropriate revision(s):

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

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

FROM
Course Subject/Number___CMPT 375_____

TO
Course Subject/Number___CMPT 375_____

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:

Abstraction principles and formalization techniques for modelling software systems in early design phases. Design is a creative activity calling for abstract models that facilitate reasoning about the key system attributes to ensure that these attributes are properly established prior to actually building a system. The focus is on specification and validation techniques rather than on formal verification.

DESCRIPTION
TO:

Abstraction principles and formalization techniques for modelling software systems in early design phases. Design is a creative activity calling for abstract models that facilitate reasoning about the key system attributes to ensure that these attributes are properly established prior to actually building a system. The focus is on specification and validation techniques rather than on formal verification.

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 101, 201. Recommended: CMPT 275.

PREREQUISITE

TO: Prerequisite: MACM 101, 201.
Recommended: CMPT 275 or 276

LEARNING OUTCOMES

RATIONALE

Introduction of CMPT 276 as part of the Software Systems major, equivalent to CMPT 275.

Effective term and year
Summer 2015