



OFFICE OF THE ASSOCIATE VICE-PRESIDENT, ACADEMIC AND  
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**MEMORANDUM**

<b>ATTENTION</b>	Senate	<b>DATE</b>	January 11, 2013
<b>FROM</b>	Gordon Myers, Chair Senate Committee on Undergraduate Studies	<b>PAGES</b>	1/1
<b>RE:</b>	Faculty of Science (SCUS 12-54)		

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For information:

Acting under delegated authority at its meeting of January 10, 2013, SCUS approved the following curriculum revisions effective Fall 2013:

1. Department of Biological Sciences (SCUS 12-54a)
  - (i) Prerequisite change to BISC 307/307W
  - (ii) Changes to Stream requirements in the Major and Honours programs
  
2. Department of Molecular Biology and Biochemistry (SCUS 12-54d)
  - (i) Number, title, description and prerequisite change for MBB 242
  - (ii) Prerequisite change for MBB 222, 231
  
3. Department of Math (SCUS 12-54e)
  - (i) Upper Division requirement changes to the Mathematics Major and Honours programs



Text to be changed is underlined

## **Biological Sciences Majors Program**

### **Program Requirements**

Students complete 120 units, as specified below.

Students should complete the lower division core requirements within the first 60 units (four terms), and are required to maintain a minimum 2.00 grade point average (GPA) in these courses.

Students are encouraged to choose their stream upon lower division core completion. Students who have had more than five course repeats are normally not permitted to remain in the program. Direct entry to the BISC major upon acceptance to the University is possible if Faculty of Science criteria is met.

- Basic unit requirements include
- BISC/MBB (lower division) 20 units
- non BISC/MBB (lower division) 27 units
- BISC/MBB (upper division) 36 units
- electives 37 units\*

### **Lower Division Requirements**

Students normally complete the following chemistry, mathematics and physics requirements as well as the lower division biological sciences courses within the first 60 units (four terms) of study.

Students complete all of

- BISC 101 General Biology (4)
- BISC 102 General Biology (4)
- BISC 202 Genetics (3)
- BISC 204 Introduction to Ecology (3)
- CHEM 121 General Chemistry and Laboratory I (4)
- CHEM 122 General Chemistry II (2)
- CHEM 281 Organic Chemistry I (4)
- MBB 222 Molecular Biology and Biochemistry (3)
- MBB 231 Cellular Biology and Biochemistry (3)
- STAT 201 Statistics for the Life Sciences (3)

and one of

- CHEM 282 Organic Chemistry II (2)
- CHEM 283 Organic Chemistry IIb (3)

and one of

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

and one of

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

and one of

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

and one of

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

Students are encouraged to complete a full year of organic chemistry. Medical, dental or veterinary school applicants should include all CHEM courses that are listed above.

### **Upper Division Requirements**

Entry into courses numbered 300 and above normally requires completion of the lower division requirements. Prerequisites for any course may be waived with the approval of the department.

Students complete a minimum of 12 upper division courses by completing all of the following, with a grade of C- or better (this minimum grade requirement also applies to BISC and MBB prerequisites).

- BISC 300 Evolution (3)
- BISC 333 Developmental Biology (3)

and one of

- BISC 305 Animal Physiology (3)
- BISC 366 Plant Physiology (3)

and at least one of

- BISC 303 Microbiology (4)
- BISC 306 Invertebrate Biology (4)
- BISC 316 Vertebrate Biology (4)
- BISC 317 Insect Biology (3)

- BISC 326 Biology of Algae and Fungi (3)
- BISC 337 Plant Biology (4)
- BISC 418 Parasitology (3)

### **Stream Requirement**

In addition to the above requirements, students choose remaining requirements in an area of specialization by completing one of three streams: cells, molecules and physiology; ecology, evolution and conservation; and an open stream. The open stream provides broad biological training, or may be used to specialize in an area not offered by the main streams (consult the undergraduate program advisor, individual faculty, or department website for advice on other areas of specialization). The course requirements for each stream are as follows.

### **Cells, Molecules and Physiology Stream**

Students who choose this stream will complete two of

- BISC 302W Genetic Analysis (3)
- BISC 307W Animal Physiology Laboratory (3)
- BISC 357 Gene Cloning (3)
- BISC 367W Plant Physiology Laboratory (3)

and three of

- BISC 303 Microbiology (4)
- BISC 313 Environmental Toxicology (3)
- BISC 403 Current Topics in Cell Biology (3)
- BISC 405 Neurobiology (3)
- BISC 429W Separation Methods in Biology (4)
- BISC 430 Microbe-Plant Interactions (3)
- BISC 432 Chemical Pesticides and the Environment (3)
- BISC 439 Industrial Microbiology (4)
- BISC 445 Environmental Physiology of Animals (3)
- BISC 449 Histological Techniques in Biology (4)
- BISC 455 Endocrinology (3)
- BISC 457 Plant Molecular Biology and Biotechnology (3)
- BISC 497W Undergraduate Research: Writing Intensive (3)
- BISC 498 Undergraduate Research I (3)
- BISC 499 Undergraduate Research II (3)

and three elective courses (nine units) from any upper division undergraduate BISC courses, or from other units at Simon Fraser University such as the Department of Molecular Biology and Biochemistry, Department of Biomedical Physiology and Kinesiology, Department of Physics, and the Faculty of Health Sciences, which may count as options towards this stream, subject to the approval by the department. Normally no more than two courses from other units may be used to satisfy stream requirements and additional upper division biology course requirements. Students complete a total of five lab courses (which

may include one of BISC 497W, 498, 499) among their upper division courses.

#### Ecology, Evolution and Conservation Stream

Students who choose this stream will complete

- STAT 302 Analysis of Experimental and Observational Data (3)

and at least one of

- BISC 304W Animal Ecology (3)
- BISC 404W Plant Ecology (3)

and four of

- BISC 309 Conservation Biology (3)
- BISC 310 The Natural History of British Columbia (3)
- BISC 406 Marine Biology and Oceanography (3)
- BISC 407 Population Dynamics (3)
- BISC 410 Behavioral Ecology (3)
- BISC 413 Fisheries Ecology (3)
- BISC 414 Limnology (3)
- BISC 419 Wildlife Biology (3)
- BISC 422 Population Genetics (3)
- BISC 434 Paleoecology and Palynology (3)
- BISC 435 Introduction to Pest Management (3)
- BISC 440 Biodiversity (3)
- BISC 440W Biodiversity (3)
- BISC 441 Evolution of Health and Disease (3)
- BISC 445 Environmental Physiology of Animals (3)
- BISC 497W Undergraduate Research: Writing Intensive (3)
- BISC 498 Undergraduate Research I (3)
- BISC 499 Undergraduate Research II (3)

and two elective courses (six units) chosen from any upper division undergraduate BISC courses. Courses from other units at Simon Fraser University such as the Faculty of Environment and MASC courses may count as options toward this stream, subject to approval by the department. Normally no more than two courses from other units and no more than three research intensive courses (BISC 490, 491, 492W, 497W, 498, or 499) may be used to satisfy stream requirements and additional upper division biology course requirements. Students complete a total of five lab courses (which may include one of BISC 497W, 498, 499) among their upper division courses.

#### Open Stream

Students who choose this stream will complete an additional 8 courses (totaling a minimum of 24 units) chosen from any upper division undergraduate BISC courses.

Courses from other units at Simon Fraser University may count as options toward this stream, subject to

approval by the department.

Normally no more than two courses from other units and no more than three research intensive courses (BISC 490, 491, 492W, 497W, 498, or 499) may be used to satisfy upper division biology course requirements.

Students complete a total of five lab courses (which may include one of BISC 497W, 498, 499) among their upper division courses.

## **Biological Sciences Honours Program**

This honours program offers independent research and in-depth study. It requires minimum of 132 units as specified below. Entry requires a cumulative grade point average (CGPA) of 3.0 or higher (B standing), and department permission. Students complete all lower division requirements as shown below, and at least 15 upper division units in biological sciences prior to application for entry. Students should contact an advisor before enrolment.

### **Program Requirement**

Students should complete the lower division core requirements within the first 60 units (four terms).

Students are encouraged to choose their stream upon lower division core completion. Students who have had more than five course repeats are normally not permitted to remain in the program. Direct entry to the BISC major upon acceptance to the University is possible if Faculty of Science criteria is met.

Basic unit requirements include

- BISC/MBB (lower division) 20 units
- non BISC/MBB (lower division) 27 units
- BISC/MBB (upper division) 45 units
- electives 25 units
- honours thesis 15 units
- total (minimum) 132 units

### **Lower Division Requirements**

Students normally complete the following chemistry, mathematics and physics requirements as well as the lower division biological sciences courses within the first 60 units (four terms) of study.

Students complete all of

- BISC 101 General Biology (4)
- BISC 102 General Biology (4)
- BISC 202 Genetics (3)
- BISC 204 Introduction to Ecology (3)
- CHEM 121 General Chemistry and Laboratory I (4)
- CHEM 122 General Chemistry II (2)
- CHEM 281 Organic Chemistry I (4)
- MBB 222 Molecular Biology and Biochemistry (3)
- MBB 231 Cellular Biology and Biochemistry (3)
- STAT 201 Statistics for the Life Sciences (3)

and one of

- CHEM 282 Organic Chemistry II (2)
- CHEM 283 Organic Chemistry IIb (3)

and one of

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

and one of

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

and one of

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

and one of

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

Students are encouraged to complete a full year of organic chemistry. Medical, dental or veterinary school applicants should include all CHEM courses that are listed above.

### **Upper Division Requirements**

Entry into courses numbered 300 and above normally requires completion of the lower division requirements. Prerequisites for any course may be waived with the approval of the department.

Honours students will complete a minimum of 60 upper division units in biological sciences, or related subjects approved by the department, which must include a research-based honours thesis as specified below.

Students complete a minimum of 12 upper division courses by completing all of the following, with a grade of C- or better (this minimum grade requirement also applies to BISC and MBB prerequisites).

- BISC 300 Evolution (3)
- BISC 333 Developmental Biology (3)

and one of

- BISC 305 Animal Physiology (3)
- BISC 366 Plant Physiology (3)

and at least one of

- BISC 303 Microbiology (4)
- BISC 306 Invertebrate Biology (4)
- BISC 316 Vertebrate Biology (4)
- BISC 317 Insect Biology (3)
- BISC 326 Biology of Algae and Fungi (3)
- BISC 337 Plant Biology (4)
- BISC 418 Parasitology (3)
- 

### **Stream Requirement**

In addition to the above requirements, students choose remaining requirements in an area of specialization by completing one of three streams: cells, molecules and physiology; ecology, evolution and conservation; and an open stream. The open stream provides broad biological training, or may be used to specialize in an area not offered by the main streams (consult the undergraduate program advisor, individual faculty, or department website for advice on other areas of specialization).

### **Cells, Molecules and Physiology Stream**

Students who choose this stream will complete two of

- BISC 302W Genetic Analysis (3)
- BISC 307W Animal Physiology Laboratory (3)
- BISC 357 Gene Cloning (3)
- BISC 367W Plant Physiology Laboratory (3)

and three of

- BISC 303 Microbiology (4)
- BISC 313 Environmental Toxicology (3)
- BISC 403 Current Topics in Cell Biology (3)
- BISC 405 Neurobiology (3)
- BISC 429W Separation Methods in Biology (4)
- BISC 430 Microbe-Plant Interactions (3)
- BISC 432 Chemical Pesticides and the Environment (3)
- BISC 439 Industrial Microbiology (4)
- BISC 445 Environmental Physiology of Animals (3)
- BISC 449 Histological Techniques in Biology (4)
- BISC 455 Endocrinology (3)
- BISC 457 Plant Molecular Biology and Biotechnology (3)
- BISC 497W Undergraduate Research: Writing Intensive (3)
- BISC 498 Undergraduate Research I (3)
- BISC 499 Undergraduate Research II (3)

and three elective courses (nine units) from any upper division undergraduate BISC courses, or from other units at Simon Fraser University such as the Department of Molecular Biology and Biochemistry, Department of Biomedical Physiology and Kinesiology, Department of Physics, and the Faculty of Health

Sciences, which may count as options toward this stream, subject to the approval by the department. Normally no more than two courses from other units and no more than three research intensive courses (BISC 490,491, 492W, 497W, 498, or 499) may be used to satisfy stream requirements and additional upper division biology course requirements. Students complete a total of five lab courses (which may include BISC 491 and one of BISC 497W, 498, 499) among their upper division courses.

#### Ecology, Evolution and Conservation Stream

Students who choose this stream will complete

- STAT 302 Analysis of Experimental and Observational Data (3)

and at least one of

- BISC 304W Animal Ecology (3)
- BISC 404W Plant Ecology (3)

and four of

- BISC 309 Conservation Biology (3)
- BISC 310 The Natural History of British Columbia (3)
- BISC 406 Marine Biology and Oceanography (3)
- BISC 407 Population Dynamics (3)
- BISC 410 Behavioral Ecology (3)
- BISC 413 Fisheries Ecology (3)
- BISC 414 Limnology (3)
- BISC 419 Wildlife Biology (3)
- BISC 422 Population Genetics (3)
- BISC 434 Paleoecology and Palynology (3)
- BISC 435 Introduction to Pest Management (3)
- BISC 440W Biodiversity (3)
- BISC 441 Evolution of Health and Disease (3)
- BISC 445 Environmental Physiology of Animals (3)
- BISC 497W Undergraduate Research: Writing Intensive (3)
- BISC 498 Undergraduate Research I (3)
- BISC 499 Undergraduate Research II (3)

and two elective courses (six units) chosen from any upper division undergraduate BISC courses. Courses from other units at Simon Fraser University such as the Faculty of Environment and MASC courses may count as options toward this stream, subject to approval by the department. Normally no more than two courses from other units and no more than three research intensive courses (BISC 490, 491,492W, 497W, 498, or 499) may be used to satisfy stream requirements and additional upper division biology course requirements. Students complete a total of five lab courses (which may include BISC 491 and one of BISC 497W, 498, 499) among their upper division courses.

Open Stream

Students who choose this stream will complete an additional 8 courses (totaling a minimum of 24 units) chosen from any upper division undergraduate BISC courses.

Courses from other units at Simon Fraser University may count as options toward this stream, subject to approval by the department.

Normally no more than two courses from other units and no more than three research intensive courses (BISC 490, 491, 492W, 497W, 498, or 499) may be used to satisfy upper division biology course requirements.

Students complete a total of five lab courses (which may include BISC 491 and one of BISC 497W, 498, 499) among their upper division courses.

### **Thesis**

In addition to the above requirements, honours students will complete a research-based thesis by completing

- BISC 490 Research Design (5)
- BISC 491 Research Technique (5)
- BISC 492W Research Reporting (5)



MEMO

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ATTENTION **George Agnes**

TEL

FROM **Ingrid Northwood; Chair, MBB undergraduate curriculum committee**

RE **1 Course number change, 2 course pre-requisite changes**

DATE **November 28, 2012**

1) **Motion 1: Change the course number MBB 242 to MBB 342**

Course number change from MBB 242 to MBB 342: this also includes slight tweaks in title, description and pre-reqs but not enough to make this an entirely new course – these changes are for clarification. MBB242 was initially developed to be an introductory course in genome science, but after two initial offerings it is clear that the material requires more background than a traditional second year course so we propose to change it to a third year course. The title has been changed to add the word bioinformatics to clarify the course content and the pre-reqs changed to add a computer course.

2) **Motion 2: Change the Pre-requisites to MBB 222 and MBB 231**

Pre-requisite changes to MBB 222 and MBB 231: By changing CHEM 281 to a co-OR prerequisite for MBB 222 (rather than only a pre-requisite) and by changing Chem 282 or 283 to a co-OR prerequisite for MBB 231 (rather than only a pre-requisite) students will be able to move through the lower division requirements for all of the life science majors more efficiently. Through discussions with the Chemistry Department we are confident that the material we are removing as pre-requisites to MBB 222 and MBB 231 is not essential to those two courses.



**Existing Course, Changes Recommended**

Please check appropriate revision(s):

XX Course number    Credit    XX Title    XX Description    XX Prerequisite    Course deletion  
Indicate number of hours for: Lecture   2      Seminar \_\_\_\_\_    Tutorial \_\_\_\_\_    Lab   2  

**FROM**

**TO**

Course Number    MBB 242 \_\_\_\_\_    Course Number    MBB 342 \_\_\_\_\_  
Credit Hour   3   \_\_\_\_\_    Credit Hour   3   \_\_\_\_\_

**TITLE**

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

Introductory Genomics \_\_\_\_\_    Introductory Genomics and Bioinformatics \_\_\_\_\_

(2) Short title for enrollment and transcript, no more than 30 characters including spaces and punctuation.

Introductory Genomics \_\_\_\_\_    Genomics and Bioinformatics \_\_\_\_\_

**DESCRIPTION**

A broad introductory survey of the genome sciences including genome organization, whole genome sequencing, genomic variation in health and disease, comparative genomics, transcriptomes and proteomes and some applications of genomics. Workshops will introduce bioinformatic approaches to the use of genomic databases.

**DESCRIPTION**

Major topics in genomics and bioinformatics, with integrated discussion of associated ethical/legal/social issues. An overview of laboratory and computer-based methods to study genomes, and their applications. Hands-on computer lab session providing an opportunity to use and experiment with bioinformatics software and databases utilized in genomics and bioinformatics research.

**PREREQUISITE**

Prerequisite: BISC 101, BISC 102, MBB 222, or permission of the department.

**PREREQUISITE**

MBB 231, BISC 202 and 3 units of CMPT or equivalent.

**RATONALE**

An introduction to Bioinformatics and Genomics requires a substantial background that students obtain in second year courses and it therefore makes sense to change this course to a third year course with second year pre-requisites. The number change is the most significant impact. The changes to title and description are for clarification. The addition of a CMPT requirement will enhance students ability to appreciate the course content.

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 **MBB 440 ST Genomics and Bioinformatics, MBB 242**

Effective term and year \_\_\_\_\_ Fall, 2013(1137)

**Approvals:**

Chair, Department/School

Nov. 7, 2012  
Date

\_\_\_\_\_

Chair, Faculty Curriculum Committee  
Date

\_\_\_\_\_

Chair, SCUS  
Date



**Existing Course, Changes Recommended**

Please check appropriate revision(s):

- Course number
- Credit
- Title
- Description
- Prerequisite
- Course deletion

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

**FROM**

**TO**

Course Number MBB 222

Course Number MBB 222

Credit Hour 3

Credit Hour 3

**TITLE**

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

Molecular Biology and Biochemistry \_\_\_\_\_

Molecular Biology and Biochemistry \_\_\_\_\_

(2) Short title for enrollment and transcript, no more than 30 characters including spaces and punctuation.

Mol Biol and Biochemistry \_\_\_\_\_

Mol Biol and Biochemistry \_\_\_\_\_

**DESCRIPTION**

An introduction to DNA replication and recombination, RNA transcription and protein synthesis in the context of their locations within the cell and their timing in the cell cycle. The relationship between structure and function of proteins and nucleic acids will be addressed

**DESCRIPTION**

An introduction to DNA replication and recombination, RNA transcription and protein synthesis in the context of their locations within the cell and their timing in the cell cycle. The relationship between structure and function of proteins and nucleic acids will be addressed

**PREREQUISITE**

Chem281 with a grade of C- or better

Co or PREREQUISITE, Chem 282

**PREREQUISITE**

. Co or PREREQUISITE - Chem 281

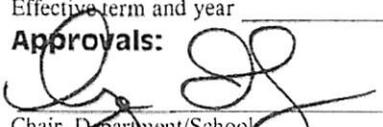
**RATONALE**

**CHEM281 is currently prerequisite to MBB222. We have determined that Chem281 provides sufficient support as a corequisite rather than prerequisite for MBB222 and that changing this pre-requisite will allow students to move more efficiently through their lower division requirements.**

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 **NO**

Effective term and year Fall, 2013(1137)

**Approvals:**

  
 Chair, Department/School  
Nov. 7, 2012  
 Date

\_\_\_\_\_  
 Chair, Faculty Curriculum Committee  
 \_\_\_\_\_  
 Date

\_\_\_\_\_  
 Chair, SCUS  
 \_\_\_\_\_  
 Date



## Summary of Changes

### Update Upper Division Requirements in our Mathematics Major and Honours Programs

Justification: To reflect changes as per Department of Statistics and Actuarial Science course offerings, SCUS 12-80.

#### From (current description-Major Program):

The Faculty of Science requires students to complete 44 upper division units. Of these 44, the Department of Mathematics requires students to complete 30 upper division units. These 30 units are divided into two groups of 15 units. The first 15 of which are prescribed are listed below.

- MATH 340 Algebra II: Rings and Fields (3)
- and one of
- MATH 308 Linear Optimization (3)
  - MATH 343 Applied Discrete Mathematics (3)
  - MATH 345 Introduction to Graph Theory (3)
- and one of
- MATH 320 Introduction to Analysis II (3)
  - MATH 322 Complex Variables (3)
- and one of
- MATH 338 Advanced Linear Algebra (3)
  - MATH 341 Algebra III: Groups (3)
  - MATH 342 Elementary Number Theory (3)
- and one of
- MATH 310 Introduction to Ordinary Differential Equations (3)
  - MACM 316 Numerical Analysis I (3)

The remaining 15 upper division units must be chosen from the following, or any combination of the following.

- any upper division MATH courses
- any upper division MACM courses
  
- PHYS 413 Advanced Mechanics (3)
- STAT 330 Introduction to Mathematical Statistics (3)
- STAT 350 Linear Models in Applied Statistics (3)
- STAT 380 Introduction to Stochastic Processes (3)
- STAT 402 Generalized Linear and Nonlinear Modelling (3)
- STAT 430 Statistical Design and Analysis of Experiments (3)
- STAT 450 Statistical Theory (3)
- STAT 460 Bayesian Statistics (3)

24 units will be in MATH or MACM courses. At least three courses will be 400 division courses, of which at least two must be in 400 division MATH or MACM courses. Directed studies, job practicum, or honours essay courses cannot be used to fulfill the 400 division requirement. Students are all required to complete an additional 14 upper division units chosen from any courses.

**To (new description-Major Program):**

The Faculty of Science requires students to complete 44 upper division units. Of these 44, the Department of Mathematics requires students to complete 30 upper division units. These 30 units are divided into two groups of 15 units. The first 15 of which are prescribed are listed below.

- MATH 340 Algebra II: Rings and Fields (3)
- and one of
- MATH 308 Linear Optimization (3)
  - MATH 343 Applied Discrete Mathematics (3)
  - MATH 345 Introduction to Graph Theory (3)
- and one of
- MATH 320 Introduction to Analysis II (3)
  - MATH 322 Complex Variables (3)
- and one of
- MATH 338 Advanced Linear Algebra (3)
  - MATH 341 Algebra III: Groups (3)
  - MATH 342 Elementary Number Theory (3)
- and one of
- MATH 310 Introduction to Ordinary Differential Equations (3)
  - MACM 316 Numerical Analysis I (3)

The remaining 15 upper division units must be chosen from the following, or any combination of the following.

- any upper division MATH courses
  - any upper division MACM courses
- 
- PHYS 413 Advanced Mechanics (3)
  - STAT 330 Introduction to Mathematical Statistics (3)
  - STAT 340 Introduction to Statistical Computing and Exploratory Data Analysis (3)
  - STAT 350 Linear Models in Applied Statistics (3)
  - STAT 380 Introduction to Stochastic Processes (3)
  - ~~STAT 402 Generalized Linear and Nonlinear Modelling (3)~~
  - STAT 430 Statistical Design and Analysis of Experiments (3)
  - STAT 445 Applied Multivariate Analysis (3)
  - STAT 450 Statistical Theory (3)
  - STAT 460 Bayesian Statistics (3)
  - STAT 475 Applied Discrete Data Analysis (3)
  - STAT 485 Applied Time Series Analysis (3)

24 units will be in MATH or MACM courses. At least three courses will be 400 division courses, of which at least two must be in 400 division MATH or MACM courses. Directed studies, job practicum, or honours essay courses cannot be used to fulfill the 400 division requirement. Students are all required to complete an additional 14 upper division units chosen from any courses.

**From (current description-Honours Program):**

Students complete a total of 60 upper division units, including the following.  
Students complete 36 units, including

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

and one of

- MATH 308 Linear Optimization (3)
- MATH 343 Applied Discrete Mathematics (3)
- MATH 345 Introduction to Graph Theory (3)

and one of

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

and one of

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

and one of

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

The remaining 30 units must be chosen from any upper division MATH or MACM courses.

Within the required 60 upper division units, 48 units will include requirements for the honours degree. Thirty-six upper division units must be chosen from upper division MATH or MACM courses, and the remaining 12 units may be chosen from the following course list.

- PHYS 413 Advanced Mechanics (3)
- STAT 330 Introduction to Mathematical Statistics (3)
- STAT 350 Linear Models in Applied Statistics (3)
- STAT 380 Introduction to Stochastic Processes (3)
- STAT 402 Generalized Linear and Nonlinear Modelling (3)
- STAT 430 Statistical Design and Analysis of Experiments (3)
- STAT 450 Statistical Theory (3)
- STAT 460 Bayesian Statistics (3)

At least five courses will be from 400 division courses, of which at least three courses will be in 400 division MATH or MACM courses. Directed studies, job practicum, or honours essay courses cannot be used to fulfill the 400 division requirement. Students are also required to complete an additional 15 upper division units chosen from any courses. In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.

**To (new description-Honours Program):**

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

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

and one of

- MATH 308 Linear Optimization (3)
- MATH 343 Applied Discrete Mathematics (3)
- MATH 345 Introduction to Graph Theory (3)

and one of

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

and one of

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

and one of

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

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

- PHYS 413 Advanced Mechanics (3)
- STAT 330 Introduction to Mathematical Statistics (3)
- STAT 340 Introduction to Statistical Computing and Exploratory Data Analysis (3)
- STAT 350 Linear Models in Applied Statistics (3)
- STAT 380 Introduction to Stochastic Processes (3)
- STAT 402 Generalized Linear and Nonlinear Modelling (3)
- STAT 430 Statistical Design and Analysis of Experiments (3)
- STAT 445 Applied Multivariate Analysis (3)
- STAT 450 Statistical Theory (3)
- STAT 460 Bayesian Statistics (3)
- STAT 475 Applied Discrete Data Analysis (3)
- STAT 485 Applied Time Series Analysis 131

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