1. Welcome and opening remarks – D. Brown
2. Minutes of the Faculty Council meeting held April 20, 2021 (attached)
3. Report from the Dean – M. Giesbrecht
4. Report from the Associate Dean, Undergraduate Studies - B. Charbonneau (attached)
   - New Courses
     - 1.1. CO 431
   - 2. Course Changes
     - 2.1. CO 430
     - 2.2. CO 485
     - 2.3. CO 487
     - 2.4. CS 136
     - 2.5. CS 146
     - 2.6. CS 241E
     - 2.7. CS 350
     - 2.8. MATH 135
     - 2.9. MATH 136
     - 2.10. PMATH 333
     - 2.11. STAT 371
   - 3. Academic Plan Changes – Major Modifications
     - 3.1. Computational Mathematics
       - 3.1.1. Plan Requirements for Computational Math
       - 3.1.2. Plan Requirements for Computational Math
     - 4. Academic Plan Changes - Minor Modifications
       - 4.1. Combinatorics and Optimization
         - 4.1.1. Plan Requirements for C&O
         - 4.1.2. Plan Requirements for Joint C&O
       - 4.2. Computer Science
         - 4.2.1. Plan Changes for HCI Specialization
       - 4.3. CS 136L Impacts
         - 4.3.1. Corrective Motion: CS 241, CS 241E, CS 246, and CS 246E
         - 4.3.2. Implementation of bi-directional corequisites: CS 136L and CS 136/146
         - 4.3.3. Affected Calendar Pages
         - 4.3.4. Issues Considered by UAC for Motion 4.3.2
       - 4.4. Statistics and Actuarial Science
         - 4.4.1. Mathematical Finance Degree Requirement
         - 4.4.2. Honours Statistics
         - 4.4.3. Honours Biostatistics
         - 4.4.4. Honours Actuarial Science August
4.5. Dean of Mathematics:
  - 4.5.1. Honours Fallback Notes
  - 4.5.2. Admissions to Specific Honours Academic Plans

5. Information
  - 5.1. Also offered Online vs Remote

5. Report from the Associate Dean, Undergraduate Admissions and Outreach – T. Vasiga

6. Report from the Associate Dean, Co-operative Studies – L. Case
  - Share your feedback on the draft Co-operative Education Learning Outcomes by participating in the research study supported by The Faculty of Mathematics. Please visit https://uwaterloo.ca/math/coop-survey-2021 for more information about the study and how to participate. Survey submissions must be received before 30th September, 2021

7. Other business
Minutes of the Mathematics Faculty Council held Tuesday, April 20, 2021 at 3:30 p.m. via Webex. There were 80 attendees.

1. The minutes of the Faculty Council meeting held February 23, 2021 were approved.

2. Dan Brown will serve as Chair of Faculty Council from September 1, 2021 to August 31, 2024.

3. Report from the Dean – Mark Giesbrecht
   - The Dean congratulated everyone for a successful term; he acknowledged the burden that has been placed on our Lecturers in particular who have higher teaching loads.
   - Planning commitments for Fall 2021 need to be made very soon. We are planning to deliver a comprehensive in-person teaching experience for students, while accommodating those who cannot come to campus. This will be done with safety of all students, faculty and staff in mind. A number of principles will be followed:
     - We will be prepared to reduce in-person delivery as necessary.
     - Students will be able to satisfy their program requirements.
     - Fall-term courses are intended to finish the way they start unless public health requirements necessitate a move to online.
     - Expectations of students having robust internet services
     - Expectation that many students will be located in Waterloo time zone
     - Math Core will be available with a strong in-person/on-campus component as well as online
   - The plan for Fall 2021 is to revert to admission targets from Fall 2019. We have a firm plan not to overshoot targets this year.
   - The Dean announced the passing of former Dean, Tom Coleman today.
   - The complete report is attached.

4. Report from the Associate Dean, Undergraduate Studies - B. Charbonneau
   - Motion Group 1. New Courses
     - Motion carried
   - Motions 2.1-2.5, 2.7, 2.8. Course Changes
     - Motion carried
   - Motion 2.6 Course Change MTHEL 199
• The motion presented in the agenda package was modified to assign a 0 credit weight to the course. The course was always intended to not generate tuition; the simplest solution is to change the course to 0 credit weight. This change was voted on at UAC, and is now presented to Faculty Council. Full details of the rationale and process are attached.

There was discussion as to whether students would be sufficiently motivated to take a 0-weight course; there were also questions around the overlap with MATH 052.

- Motion carried as amended.

• Motion 3.1: Plan Change AM Minor
  - Motion carried

• Motions 3.2-3.5: Plan Changes
  - Motion carried

• Motions 3.6-3.9: Plan Changes
  - Motion carried

• Beginning Spring 2021, Math will partner with Renison University College to provide on-campus English language education to support our incoming Faculty of Mathematics students. This will replace our previous long-standing partnership with Conestoga College for the Math/English Language for Academic Studies program. The Associate Dean asked permission from the Council to make the changes in the calendar; this was agreed by a straw poll.

5. Faculty of Math Campaign Report: this item was deferred.

6. Faculty Council meeting dates for 2021/2022 were announced. Meetings will be continued to be conducted remotely until further notice:

  • Tuesday September 28, 2021 at 3:30 PM
  • Tuesday November 16, 2021 at 3:30 PM
  • Tuesday March 1, 2022 at 3:30 PM
  • Tuesday April 19, 2022 at 3:30 PM

7. Other business
   • None.

The meeting adjourned at 5:01 PM.
Presented by: Mark Giesbrecht, Dean of Mathematics
Presented to: Faculty of Mathematics Faculty Council
Date: April 20, 2021
Another pandemic term done

- Congratulations to everyone one delivering another great term
- I recognize it has not been easy for anyone, and a special burden has been placed on our Lecturers who have higher teaching loads and are providing incredible teaching, course development, and service, especially in the past year
- On campus activity: This past term we successfully delivered 17 sections of Math 136 and Math 138 to more than 350 very grateful students
- And it all starts again in a couple of weeks for Spring term!
Fall Term 2021 – Philosophy, Projections and Plans

While we are now in a scary third outbreak wave, increasing vaccine supply and better testing give us hope for the Fall 2021

- Many of the planning commitments need to be made very soon, leaving in as much adaptability as possible and committing the resources, especially your time and energy

- We will continue to deliver the best possible educational experience in the fall, both on campus and online

- We plan a staged and strategic move back to “regular” operations for students and employees in the fall term
  - We are planning to deliver a comprehensive in-person teaching experience for students starting in F21 term, while accommodating those who cannot come to campus
  - This will be done with the safety of all students, faculty and staff in mind
  - We want to be flexible to tackle unexpected challenges, including pandemic changes
Fall 2021 class delivery principles

- UW plans to offer more in-person education in Fall, within required physical distancing restrictions
  - Using expected public health guidelines classrooms will be scheduled at 50% of normal classroom capacity
- Because we can’t confirm what public health restrictions will be in place in the fall, we will be prepared to reduce in-person delivery as necessary to meet any alternate restrictions around physical distancing, gathering size and safety.
- Students who are unable to learn in-person in the fall will be given an opportunity to satisfy their program requirements online
  - This implies that not all courses need be on-campus or online, but there must be a path through for online students, and strong support for those who are able to come to campus
- Fall-term courses are intended to finish the way they start:
  - If a course starts online, it will remain online until the end of term and will not transition to in-person.
  - If a course starts in person or in some kind of “blended” mode, it will remain in person unless public health requirements necessitate a move to online.
Fall 2021 class expectations

- There is a greater expectation of students being on or near campus
  - Potential for flipped/mixed mode with some lectures, tutorials, labs and office hours to be in person and some online, subject to social distancing and physical space availability

- Expectations of more students having robust internet
  - Synchronous and recorded classroom lecturers will be a viable mode of delivery (even if it is understood often not to be the best mode in many circumstances)
  - Technological support is being investigated and installed by IST and MFCF

- Expectation many students (esp. more senior) will be located in the Waterloo time zone
  - Fewer accommodations need to be made for those in other time zones, esp. 2B and after
  - International first-year students and 2A students may not be able to get to campus
Fall 2021 Math delivery

The MUO, teaching fellows, and individual units – and all of you – are working hard to put together a strong and flexible plan for teaching in F21

- It seems like the continuation of a great slog after a year of online classes and course redevelopment
- I recognize the stress many of you are under and reiterate my appreciation of the fantastic job you all have done.
- Our hope and plan is not to burden anyone with unnecessary development, leveraging what we have developed over the past year and providing a great experience to the students as we move back on campus
- We also recognize that we are dealing with a bulge of students which would have put pressure on our delivery in the best of times

I do want to encourage that those students who do come to campus get a great experience
Fall 2021 Math delivery

- Math Core will be available with a strong in-person/on-campus component as well as online
  - There will be opportunities for Waterloo-based students to participate on campus
  - There will be availability for fully remote learning

- 1A term
  - Plan to offer Math 135, Math 137 in an online and in-person format in Fall 2021
  - Hope to offer Math 145, Math 147 online and on campus - TBD
  - CS is exploring a blended approach to CS115 and 135, with online and on-campus components available

- More senior courses will be offered on campus as resources and circumstances permit
  - There may be choices made to offer some courses online-only or on campus-only

- Graduate courses may be offered online or on campus (physical distancing permitted)
Expectations on Math Faculty

I know many faculty members will be very happy to get back to campus for teaching and research

- We hope you will be amenable to your assigned teaching and service activities, on campus and online, as conditions permit
- Those with health-related risks/concerns around COVID should be able to choose to teach online only
- As always, we will try to accommodate everyone’s teaching preferences, but appreciate your flexibility and support
Fall 2021 Undergrad Admissions “Reminder”

- The plan for Fall 2021 is to snap back to Fall 2019 admission targets
- We’ve made around 1200 offers so far
- Will make around another 3000 offers in early May
- There is a very firm plan not to overshoot our targets!
- Applications numbers in Math overall up 11% overall
  - CS application numbers are up 20%!
Sad News

Professor Tom Coleman passed away this morning after a battle with cancer

Tom was Dean of the Faculty of Mathematics from 2005-2010. He made so many contributions as a Dean and faculty member at Waterloo, in research, teaching and service, including his leadership on the business and finance program and the Math 3 building.

Please join me in passing on our condolences to his wife Yuying Li (CS) and family and visit the memorial site at https://www.caringbridge.org/visit/thomasfcoleman/journal/
QUESTIONS?
Proposed new calendar description (changes in blue and red) [Effective 1 May 2021]

MTHEL 99 LEC 0.00 Course ID: 016214

First-Year Mathematics Readiness
A skills-based course designed to help the incoming university student refresh their knowledge of secondary school mathematics. It includes extra practice with the following topics: Inequalities and Absolute Values, Radicals and Rational Expressions, Trigonometry, Exponential and Logarithmic Functions, Polynomials, and Introductory Calculus.

[Note: This course will be graded on a Credit/No-Credit basis.]

Also offered Online

Rationale:
When MTHEL 199 was created last year as an emergency motion for our response to the Covid 19 pandemic. The Math Faculty was exploring ways to provide remedial mathematics to our incoming high school class whose senior mathematics courses were disrupted by the COVID crisis. One option was to provide a remedial course covering key high school topics. The course itself had not been designed by the time the MTHEL 199 vessel was created, and it was not even fully decided if there would be such a course. It was thus reasonable at the time to make it a generic topics course. There was a strong desire in the Faculty of Mathematics that this course, should it be offered, would not increase student tuition because it covers high school material. During July 2020, the course was shaped. For students taking less than 2.5 units, there was a lot of MUO manual work in fall 2020 to prevent students being charged tuition. By January 2021, the course had now been coded so that tuition would not be triggered. Since the course now exists and is coded to avoid tuition, we should prevent the possibility that other topics could be taught through it, hence the new title and description. This move to zero-billing units was done without provostial support and is creating problems. It is unclear if provostial support would be granted. There were additional issues with regards to Laurier based DD students. The simplest solution is to change the course to 0 credit weight. The RO has suggested that renumbering from 199 to 99 because of the level of the material. Permission for 2021 effective date obtained from RO.
Process

- UAC voted on original motion at its last meeting on 29 March
- The following week, discussions with Associate Provost have indicated a problem
- UAC was consulted electronically on whether they see problems with 0 credits, if they preferred to delay, etc
- UAC was informed of all arguments presented
- Then UAC was asked to vote electronically last Friday.
  - Do you agree to vote electronically?
    - 100% yes
  - Do you agree with modified motion?
    - 12 voting members
      - 12 yes
    - 6 non-voting members
      - 3 yes
      - 1 against
      - 1 abstain
Report of Undergraduate Affairs Committee to Mathematics Faculty Council

This September 2021 report contains several motions from the Mathematics Undergraduate Affairs Committee (UAC) to be voted on at this Faculty Council meeting. These motions were adopted by UAC during its May – August 2021 meetings.

1. New Courses
   1.1. CO 431

2. Course Changes
   2.1. CO 430
   2.2. CO 485
   2.3. CO 487
   2.4. CS 136
   2.5. CS 146
   2.6. CS 241E
   2.7. CS 350
   2.8. MATH 135
   2.9. MATH 136
   2.10. PMATH 333
   2.11. STAT 371

3. Academic Plan Changes – Major Modifications
   3.1. Computational Mathematics
      3.1.1. Plan Requirements for Computational Math
      3.1.2. Plan Requirements for Computational Math

4. Academic Plan Changes - Minor Modifications
   4.1. Combinatorics and Optimization
      4.1.1. Plan Requirements for C&O
      4.1.2. Plan Requirements for Joint C&O
   4.2. Computer Science
      4.2.1. Plan Changes for HCI Specialization
   4.3. CS 136L Impacts
      4.3.1. Corrective Motion: CS 241, CS 241E, CS 246, and CS 246E
      4.3.2. Implementation of bi-directional corequisites: CS 136L and CS 136/146
      4.3.3. Affected Calendar Pages
      4.3.4. Issues Considered by UAC for Motion 4.3.2
   4.4. Statistics and Actuarial Science
      4.4.1. Mathematical Finance Degree Requirement
      4.4.2. Honours Statistics
      4.4.3. Honours Biostatistics
      4.4.4. Honours Actuarial Science August
   4.5. Dean of Mathematics:
      4.5.1. Honours Fallback Notes
      4.5.2. Admissions to Specific Honours Academic Plans

5. Information
   5.1. Also offered Online vs Remote
NEW COURSES  (for approval)

Combinatorics & Optimization

Effective 01-SEP-2022

CO  431 (0.50)  LEC  Symmetric Functions
The ring of symmetric functions, standard bases, the Hall inner product. Young tableaux. The Robinson-Schensted-Knuth correspondence, the hook-length formula, the Jacobi-Trudi formula, the Pieri rule, the Littlewood-Richardson rule. Representation theory of the symmetric groups. Enumeration of plane partitions. Enumeration of maps on surfaces. Other topics.

Requisites: Prereq: PMath 336 or PMath 347; Cumulative overall average of at least 80%
Rationale: In March 2011, CO 630 was split into two classes (CO 630 and CO 631). CO 630 was (and still is) held with CO 430. At the time of its creation, CO 631 Symmetric Functions was a grad-only course. The C&O department and the broader research community have now evolved to the point where it makes sense to offer an undergraduate version of CO 631. In the past, we have always offered CO 631 every two years in the fall. Moving forward, we would offer CO 431/631 every fall.

COURSE CHANGES  (for approval)

Current Catalog Information

CO  430 (0.50)  LEC  Algebraic Enumeration
The algebra of Laurent series and Lagrange's Implicit function theorem, enumerative theory of planar embeddings (maps). The ring of symmetric functions: Schur functions, orthogonal bases, inner product, Young tableaux, and plane partitions. Non-intersecting paths, sieve methods, partially ordered sets, and Mobius inversion, strings with forbidden substrings, the Cartier-Foata commutation monoid. Introduction to the group algebra of the symmetric group, enumerative applications of sl(2). [Offered: W]
No Special Consent Required

Requisites: Prereq: CO 330; Cumulative overall average of at least 80%

Rationale: CO 430's description was not updated when CO 630 was updated some years ago. The two courses are offered together and so the descriptions should
match. We also decided to remove the offering term information for greater flexibility.

**Current Catalog Information**

**CO 485 (0.50) LEC**  
The Mathematics of Public-Key Cryptography  
No Special Consent Required  
Requisites: Prereq: One of PMATH 334, 336, 345, 346, 347; Cumulative overall average of at least 80%

**Effective 01-SEP-2022**  
Rationale: Update the course description to better reflect the course contents.

**Current Catalog Information**

**CO 487 (0.50) LEC**  
Applied Cryptography  
A broad introduction to cryptography, highlighting the major developments of the past twenty years. Symmetric ciphers, hash functions and data integrity, public-key encryption and digital signatures, key establishment, key management. Applications to Internet security, computer security, communications security, and electronic commerce. [Offered: W]  
No Special Consent Required  
Requisites: Prereq: MATH 135 or 145, STAT 206 or 220 or 230 or 240; Level at least 3A

**Effective 01-SEP-2022**  
Description Change: A broad introduction to modern cryptography, highlighting the tools and techniques used to secure internet and messaging applications. Symmetric-key encryption, hash functions, message authentication, authenticated encryption, public-key encryption and digital signatures, key establishment, key management. [Offered: F,W]  
Requisite Change: Prereq: MATH 135 or 145, STAT 206 or 220 or 230 or 240, CS 116 or 136 or 138 or 146; Level at least 3A  
Rationale: 1. Update the course description to better reflect the course contents. 2. Change the course offerings from W to F,W. (We have indeed been offering CO 487 every F,W for the past two years. Enrolment has increased from ~100 students/year ten years ago to ~400 students/year today.) 3. Add CS 116/136/138/146 as a prerequisite. Some instructors require programming on assignments, so including this prerequisite informs potential students that the course might require some programming.

Computer Science - David R. Cheriton School of
Current Catalog Information
CS 136 (0.50) LAB, LEC, TST, TUT Elementary Algorithm Design and Data Abstraction
This course builds on the techniques and patterns learned in CS 135 while making the transition to use an imperative language. It introduces the design and analysis of algorithms, the management of information, and the programming mechanisms and methodologies required in implementations. Topics discussed include iterative and recursive sorting algorithms; lists, stacks, queues, trees, and their application; abstract data types and their implementations. [Note: See Note 2 above. Offered: F,W,S]
No Special Consent Required
Requisites:
Prereq: At least 90% in CS 115 or at least 70% in CS 116 or at least 60% in CS 135 or CS 145. Antireq: CS 137, 138, 146, PHYS 239
Effective 01-SEP-2022
Requisite Change:
Prereq: At least 90% in CS 115 or at least 70% in CS 116 or at least 60% in CS 135 or CS 145. Antireq: CS 137, 138, 146, PHYS 239 Coreq: CS 136L
Rationale:
Change shows how the new course CS 136L relates to CS 136 and that CS 136L should be taken at the same time as CS 136 or CS 146.

Current Catalog Information
CS 146 (0.50) LAB, LEC, TST, TUT Elementary Algorithm Design and Data Abstraction (Advanced Level)
CS 146 is an advanced-level version of CS 136. [Note: See Note 2 above. This course may be substituted for CS 136 in any degree plan or for prerequisite purposes. Students who receive a good grade in CS 135 may contact the instructor of CS 146 to seek admission without the formal prerequisites. Offered: W]
No Special Consent Required
Requisites:
Prereq: CS 145 with a grade of at least 75%. Antireq: CS 116, 136, 137, 138.
Effective 01-SEP-2022
Requisite Change:
Prereq: CS 145 with a grade of at least 75%. Antireq: CS 116, 136, 137, 138. Coreq: CS 136L
Rationale:
Change shows how the new course CS 136L relates to CS 146 and that CS 136L should be taken at the same time as CS 136 or CS 146.

Current Catalog Information
CS 241E (0.50) LAB, LEC, TST, TUT Foundations of Sequential Programs (Enriched)
Enriched version of CS 241. [Note: See notes 1 and 9 above. CS 241E may be substituted for CS 241 wherever the latter is a requirement. Enrollment is restricted. Lab is not scheduled and students are expected to find time in open hours to complete their work. CS 251 is a recommended corequisite. Offered: As permitted by demand and available resources.]
No Special Consent Required
Requisites:
Prereq: (CS 136L and a grade of 85% or higher in one of CS 136 or CS 146), or a grade of 85% or higher in CS 138; Computer Science and BMa (Data Science) students only. Antireq: CS 230, GENE 344
Effective 02-SEP-2022
Requisite Change :
Prereq: (CS 136L and a grade of 85% or higher in one of CS 136 or CS 146),
or a grade of 85% or higher in CS 138; Computer Science and BMath (Data
Science) students only. Antireq: CS 230, ECE 351
Rationale :
GENE 344 has last been offered in Spring 2005 and was inactivated in
September 2005. CS 241E is the enriched version of CS 241, and the regular
version has ECE 351 as an antireq. We add the antireq to CS 241E as well
for consistency.

Current Catalog Information
CS 350 (0.50) LAB, LEC, TST Operating Systems
An introduction to the fundamentals of operating system function, design, and
implementation. Topics include concurrency, synchronization, processes, threads,
scheduling, memory management, file systems, device management, and security. [Note:
Enrolment is restricted; see Note 1 above. Lab is not scheduled and students are
expected to find time in open hours to complete their work. Offered: F,W,S]
No Special Consent Required
Requisites :
Prereq: CS 240, 241, 246, (CS 251 or ECE 222); Computer Science students
only. Antireq: ECE 254, MTE 241, SE 350

Effective 01-SEP-2022
Requisite Change :
Prereq: CS 240, 241, 246, (CS 251 or ECE 222); Computer Science students
only.
Antireq: ECE 254, MTE 241, SE 350, ECE 350
Rationale :
There is a new ECE Operating systems course and it is similar enough in
content to include it on the list of anti-requisites for CS350.

Dean of Mathematics

Current Catalog Information
MATH 135 (0.50) LEC, TST, TUT Algebra for Honours Mathematics
An introduction to the language of mathematics and proof techniques through a study
of the basic algebraic systems of mathematics: the integers, the integers modulo n,
the rational numbers, the real numbers, the complex numbers and polynomials.
[Offered: F,W,S]
No Special Consent Required
Requisites :
Prereq: 4U Calculus and Vectors or 4U Mathematics of Data Management;
Honours Mathematics or Mathematics/ELAS or Software Engineering students
only. Antireq: MATH 145

Effective 01-JAN-2022
Requisite Change :
Prereq: 4U Calculus and Vectors or 4U Mathematics of Data Management;
Honours Mathematics or Mathematics/Base or Software Engineering students
only. Antireq: MATH 145
Rationale :
To change the note section and replace the acronym ELAS with BASE.
Beginning Spring 2021, the Faculty of Mathematics will partner with Renison
University College to provide on-campus English language education to
support our incoming Faculty of Mathematics students. They would still be enrolled in a non-degree term, and still take Math 137 for the most of them, but the provider is now Bridge to Academic Success in English (BASE) instead of English Language for Academic Studies (ELAS).

Current Catalog Information
MATH 136 (0.50) LAB, LEC, TST, TUT Linear Algebra 1 for Honours Mathematics


No Special Consent Required

Requisites:
Prereq: (MATH 135 with a grade of at least 60% or MATH 145; Honours Mathematics or Mathematics/ELAS students) or Science Mathematical Physics students. Antireq: MATH 106, 114, 115, 146, NE 112

Effective 01-JAN-2022

Requisite Change:
Prereq: (MATH 135 with a grade of at least 60% or MATH 145; Honours Mathematics or Mathematics/BASE students) or Science Mathematical Physics students. Antireq: MATH 106, 114, 115, 146, NE 112

Rationale:
To change the note section and replace the acronym ELAS with BASE.

Beginning Spring 2021, the Faculty of Mathematics will partner with Renison University College to provide on-campus English language education to support our incoming Faculty of Mathematics students. They would still be enrolled in a non-degree term, and still take Math 137 for the most of them, but the provider is now Bridge to Academic Success in English (BASE) instead of English Language for Academic Studies (ELAS).

Pure Mathematics

Current Catalog Information
PMATH 333 (0.50) LEC Introduction to Real Analysis

The purpose of the course is to present the familiar concepts of calculus at a rigorous level and to provide students who took the MATH 137/MATH 138/MATH 237 sequence with the background needed to be successful in PMATH 351 and PMATH 352. Topics discussed include the completeness properties of the reals; the density of the rationals; the topology of real n-dimensional space: open and closed sets, connectedness, compactness (by open covers), the Heine-Borel theorem, completeness; sequences in real n-dimensional space: convergence, Cauchy sequences, subsequences, the Bolzano-Weierstrass theorem; multivariable functions: limits, point-wise and uniform continuity, the extreme value theorem, uniform convergence of sequences of functions, Taylor's theorem, term-by-term differentiation of power series; integration in real n-dimensional space: Riemann integrability, Fubini's theorem for continuous functions on rectangles, term-by-term integration of power series.

No Special Consent Required

Requisites:
Prereq: MATH 138 or 148. Coreq: MATH 237. Antireq: MATH 247

Effective 01-SEP-2022
Requisite Change : Prereq: MATH 128 with at least 70% or MATH 138 with at least 60% or MATH 148. Coreq: (MATH 235 or 245) and MATH 237. Antireq: MATH 247.
Rationale : The change to the calculus 2 prerequisite (MATH 138 or 148) harmonizes this prerequisite with the existing calculus 2 prerequisite listed for MATH 237, which remains a corequisite for PMATH 333. The addition of the linear algebra corequisite MATH 235 or 245 is in response to the recent revisions to the linear algebra core courses. In particular, the virtual prerequisite of MATH 136 via MATH 237 no longer guarantees exposure to abstract linear algebra. Adding MATH 235 or 245 as a corequisite will ensure that students have exposure to abstract vector spaces pitched at the appropriate level.

Statistics & Actuarial Science

Current Catalog Information

STAT  371 ( 0.50 )  LEC, TUT Applied Linear Models and Process Improvement for Business
Practical and theoretical aspects of simple and multiple linear regression models.
Model building, fitting and assessment. Process thinking and improvement. Strategies
for variation reduction such as control charting. Process monitoring, control and
adjustment. Applications to problems in business. [Offered: F,W,S]
No Special Consent Required
Requisites :
Prereq: (MATH 235 or 245) and (STAT 231 with a grade of at least 60% or
STAT 241); Bus/Math dbl degree, Math/Bus, Math/FARM, Math/ITM, or Math
Optimization - Business Spec students only. Antireq: ECON 321, STAT 321, 331, 373

Effective 01-SEP-2022
Requisite Change :
Prereq: (MATH 235 or 245) and (STAT 231 with a grade of at least 60% or
STAT 241); Bus/Math dbl degree, Math/Bus, Math/FARM, Math/ITM, or Math
Optimization - Business Spec students only.
Antireq: STAT 321, 331, 373
Rationale :
ECON updated their courses and removed ECON 321 in the 2019/2020 calendar
and the course is no longer being offered. There are no active mathematics
students with credits for ECON 321, the latest having graduated this June.

End of Report
3 Academic Plan Changes – Major Modifications

3.1 Computational Mathematics

3.1.1-3.1.2 Plan Requirements for Computational Mathematics

Effective Date: 01 September 2022

Background and rationale: Effective 1 September 2022, a number of changes are being made to

- Computational Mathematics
- Computational Mathematics Minor

These interdisciplinary programs are composed of foundational and specialized computational mathematics courses that are offered by the Faculty of Mathematics as a whole, including courses from all four departments (Applied Mathematics, Combinatorics & Optimization, Pure Mathematics, Statistics and Actuarial Sciences) and the School of Computer Science. A review of the programs has identified the need to update some of the course options and make some refinements to the structure of the programs (without changes to the total number of required courses).

The changes fall under 4 categories, labelled A to D below.

Affected pages:
http://ugradcalendar.uwaterloo.ca/page/MATH-Computational-Mathematics
http://ugradcalendar.uwaterloo.ca/page/MATH-Computational-Mathematics-Minor

A) Effective 1 September 2022, the following changes are being made to Computational Mathematics academic plans (honours, minor):

- [A1] Add to list of “additional” approved courses a number of courses that are either new and a good fit, or that increase the interdisciplinary breath of the programs:
  - AMATH 383, AMATH 477, CS 479
  - CO 463, CO 466, CO 471
  - AMATH 343, AMATH 391, AMATH 455
- [A2] Put a restriction on the “additional courses list” to require that courses be taken from at least two different subject codes and a note that AMATH 382/BIOL 382 is considered an AMATH subject for the purpose of this rule.
- [A3] Update language of a note regarding the fact that a certain number of courses are restricted to Computer Science students
- [A4] Import a number of rules from the honours plan to the minor for consistency
  - Add CS 431 as alternative to CS 451
  - Add CO 255 as alternative to CO 250

B) Effective 1 September 2022, the following changes are made to the Computational Mathematics (honours) plan:

- [B1] To ensure depth, require that at least two of the “four additional courses” are taken at the 400 level
[B2] to increase the breadth students, split the current heterogeneous list of “four out of six core courses” (ranging between years two and four) into two more focused lists out of which students are required two courses with different subject codes:
  o a first list of “two out of four (second-year, foundational) courses” (CO 250 or CO 255; CS 245 or PMATH 330; CS 246)
  o a second list of “two out of five (upper-year) core courses” (AMATH 342; CS 475; STAT 340 or STAT 341).
By contrast, in the current setup students could take three CS courses. With the new core course list, students will be required to take at least two upper-year CM core courses that have full focus on CM topics, whereas the previous core list contained several second-year courses that are more of a preparatory nature without full focus on core CM material.
[B3] Add
  o to first list of foundational courses: AMATH 250 or 251 or 350 (all considered equivalent)
  o to second list of core courses: CO 367 or CO 353; PMATH 370
  o to list of additional courses: the possibility to take courses from the core list.
[B4] Allow students who take CO 255 (Advanced Level Introduction to Optimization) to take CO 466 or CO 450 as a core course instead of CO 367 or CO 353. This is in line with the setup of the CO major and the prerequisites of these courses, where strong students who take the advanced CO 255 instead of CO 250 may directly enter CO 466 or CO 450 without having to first take CO 367 or CO 353.
[B5] To prevent confusion and simplify advising, add specific lists of Science and Engineering subject codes departments that are eligible for the course concentration component, specifically
  o For science: BIOL, CHEM, EARTH, MNS, PHYS,
  o For engineering: AE, BME, CHE, CIVE, ECE, GEOE, ENVE, ME, MTE, MSCI, NE, or SYDE.

C) Effective 1 September 2022, the following changes are made to the Computational Mathematics Minor:
[C1] Remove a restriction that at most three courses may also be used to satisfy an explicit choice list course requirement of the student’s major. Without that restriction, and with the additional breadth requirement of part A2, most students are required to take, among their 7 required CM minor courses, at least 3 courses that cannot be counted as courses for their major, in addition to needing to choose several other courses in their major area specifically in the area of Computational Mathematics (among a broad choice of non-CM courses in their major). This is an appropriate balance.
[C2] There are two exceptions that must be addressed explicitly:
  o For Data Science majors, at most five courses can have (or be cross-listed with courses having) a CS or STAT subject code.
  o For Computer Science majors, at most four courses can have (or be cross-listed with courses having) a CS subject code.
Current rules are too generous to Data Science students (who can claim the CM minor by taking as little as one elective, CS 371, that cannot be used towards their explicit major course requirement), and too restrictive for Computer Science majors compared to other programs of the Faculty (for example, Statistics majors pursuing a CM minor need, in the
new rules proposed here, to take at least 3 non-STAT courses in CM in addition to explicitly choosing 4 STAT courses that are part of the CM minor).

- [C3] Add Software Engineering (SE) accepted alternatives and indicate they are restricted to SE students only:
  - SE 212 for CS 245 or PMATH 330
  - CS 247 for CS 246

D) Effective 1 September 2022, a number of editorial changes are made to the Computational Mathematics (honours) plan to simplify the presentation, prevent student and advisor confusion, and simplify further updates.

- [D1] Add a note concerning course replacements that have enrolment restricted to Computer Science students. For those students
  - CS 241 may be substituted for CS 230
  - CS 240 may be substituted for CS 234
  The previous calendar text suggested to students to take one course from each pair.
- [D2] Remove information about prerequisites for certain courses as the information is better maintained in the course descriptions.

In red, deletion. In blue, addition. In [green], reference to motion (not included in actual change).

Computational Mathematics
(http://ugradcalendar.uwaterloo.ca/page/MATH-Computational-Mathematics1)

Calendar text (to be included in FC submission but not SUC submission):

Students in this plan must fulfil all the requirements in Table 1 and Table 2. This must include at least 26 math courses and the following specific requirements:

One of
- MATH 237 Calculus 3 for Honours Mathematics
- MATH 247 Calculus 3 (Advanced Level)

One of
- MATH 239 Introduction to Combinatorics
- MATH 249 Introduction to Combinatorics (Advanced Level)

All of
- AMATH 242/CS 371 Introduction to Computational Mathematics

One All of
- CS 230 Introduction to Computers and Computer Systems
- CS 234 Data Types and Structures

Note: Computational Mathematics majors currently or previously enrolled as Computer Science students may substitute:

- CS 241 for CS 230
- CS 240 for CS 234

Two of the following foundational courses, with different subject codes (AMATH, CO, CS, PMATH, or STAT)
**AMATH 250** Introduction to Differential Equations or **AMATH 251** Introduction to Differential Equations (Advanced Level) or **AMATH 350** Differential Equations for Business and Economics  

**CO 250** Introduction to Optimization or **CO 255** Introduction to Optimization (Advanced Level)

**CS 245** Logic and Computation or **PMATH 330** Introduction to Mathematical Logic

**CS 246** Object-Oriented Software Development

Two courses from the following list of core courses

**AMATH 342** Computational Methods for Differential Equations

**CO 367** Nonlinear Optimization or **CO 353** Computational Discrete Optimization

**CS 475** Computational Linear Algebra

**PMATH 370** Chaos and Fractals

**STAT 340** Stochastic Simulation Methods or **STAT 341** Computational Statistics and Data Analysis

Four additional courses that may include any of the courses on the core course list above [B3], or may be chosen from the following list, using at least two different subject codes (from AMATH, CO, CS, PMATH, and STAT) [A2], and at least two of which must be 400-level courses [B1]

**AMATH 343** Discrete Models in Applied Mathematics

**AMATH 382/BIOL 382** Computational Modelling of Cellular Systems (considered in subject code AMATH)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMATH 383</td>
<td>Introduction to Mathematical Biology</td>
</tr>
<tr>
<td>AMATH 391</td>
<td>From Fourier to Wavelets</td>
</tr>
<tr>
<td>AMATH 442</td>
<td>Computational Methods for Partial Differential Equations</td>
</tr>
<tr>
<td>AMATH 455</td>
<td>Control Theory</td>
</tr>
<tr>
<td>AMATH 477</td>
<td>Stochastic Processes for Applied Mathematics</td>
</tr>
<tr>
<td>CO 351</td>
<td>Network Flow Theory</td>
</tr>
<tr>
<td>CO 370</td>
<td>Deterministic OR Models</td>
</tr>
<tr>
<td>CO 372</td>
<td>Portfolio Optimization Models</td>
</tr>
<tr>
<td>CO 452</td>
<td>Integer Programming</td>
</tr>
<tr>
<td>CO 454</td>
<td>Scheduling</td>
</tr>
<tr>
<td>CO 456</td>
<td>Introduction to Game Theory</td>
</tr>
<tr>
<td>CO 450</td>
<td>Combinatorial Optimization</td>
</tr>
<tr>
<td>CO 463</td>
<td>Convex Optimization and Analysis</td>
</tr>
<tr>
<td>CO 466</td>
<td>Continuous Optimization</td>
</tr>
<tr>
<td>CO 471</td>
<td>Semidefinite Optimization</td>
</tr>
<tr>
<td>CO 485</td>
<td>The Mathematics of Public-Key Cryptography</td>
</tr>
<tr>
<td>CO 487</td>
<td>Applied Cryptography</td>
</tr>
<tr>
<td>CS 341</td>
<td>Algorithms</td>
</tr>
<tr>
<td>CS 431</td>
<td>Data-Intensive Distributed Analytics or CS 451</td>
</tr>
<tr>
<td>CS 451</td>
<td>Data-Intensive Distributed Computing</td>
</tr>
<tr>
<td>CS 466</td>
<td>Algorithm Design and Analysis</td>
</tr>
<tr>
<td>CS 476</td>
<td>Numerical Computation for Financial Modeling</td>
</tr>
<tr>
<td>CS 479</td>
<td>Neural Networks</td>
</tr>
<tr>
<td>CS 480</td>
<td>Introduction to Machine Learning</td>
</tr>
<tr>
<td>CS 482</td>
<td>Computational Techniques in Biological Sequence Analysis</td>
</tr>
<tr>
<td>CS 485</td>
<td>Statistical and Computational Foundations of Machine Learning</td>
</tr>
<tr>
<td>CS 487</td>
<td>Introduction to Symbolic Computation</td>
</tr>
<tr>
<td>STAT 440</td>
<td>Computational Inference</td>
</tr>
<tr>
<td>STAT 441</td>
<td>Statistical Learning - Classification</td>
</tr>
<tr>
<td>STAT 442</td>
<td>Data Visualization</td>
</tr>
<tr>
<td>STAT 444</td>
<td>Statistical Learning - Function Estimation</td>
</tr>
</tbody>
</table>

Three (1.5 units) non-math courses, at least one of which must be at the 200-, 300-, or 400-level, from one of the following departments (other course concentrations may be eligible subject to approval by a Computational Mathematics advisor):
- Economics
- any one Science department program (one of subject codes BIOL, CHEM, EARTH, MNS, or PHYS)
- any one Engineering department program (one of subject codes AE, BME, CHE, CIVE, ECE, GEOE, ENVE, ME, MTE, MSCI, NE, or SYDE) [B5]

Notes

1. CS 240 requires CS 245 and CS 246 as prerequisites; CS 241 requires CS 246 as a prerequisite. CS 240 and CS 241 have restricted access for non-Computer Science majors.
2. CS 245 and CS 246 require CS 136 as a prerequisite. [D2]
1. CS 341, CS 451, CS 466, CS 480, and CS 485 have restricted access for non-Computer Science majors. They are restricted to Computer Science students only. [A3]
2. Students who take CO 255 may take CO 466 or CO 450 as a core course instead of CO 367 or CO 353. [B4]
3. Engineering courses may not be open to Mathematics students or may not easily fit schedules.

Computation Mathematics Minor
(http://gradcalendar.uwaterloo.ca/page/MATH-Computational-Mathematics-Minor)

Calendar text (to be included in FC submission but not SUC submission):

This Minor is only available to students within the Faculty of Mathematics.

One of

AMATH 242/CS 371 Introduction to Computational Mathematics
CS 370 Numerical Computation

Three of

AMATH 342 Computational Methods for Differential Equations
CO 250 Introduction to Optimization or CO 255 Introduction to Optimization (Advanced Level) [A5]

CS 245 Logic and Computation or PMATH 330 Introduction to Mathematical Logic or SE 212 Logic and Computation [C3]

CS 246 Object-Oriented Software Development or CS 247 Software Engineering Principles [C3]

CS 475 Computational Linear Algebra

STAT 340 Stochastic Simulation Methods or STAT 341 Computational Statistics and Data Analysis

Three additional courses from the following list, using at least two different subject codes (from AMATH, CO, CS, PMATH, or STAT) [B2]

AMATH 343 Discrete Models in Applied Mathematics [A1]
AMATH 382/BIOL 382 Computational Modelling of Cellular Systems (considered in subject code AMATH) [A2]
AMATH 383 Introduction to Mathematical Biology
AMATH 391 From Fourier to Wavelets [A1]
AMATH 442 Computational Methods for Partial Differential Equations
AMATH 455 Control Theory [A1]
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMATH 477</td>
<td>Stochastic Processes for Applied Mathematics</td>
<td>[A1]</td>
</tr>
<tr>
<td>CO 351</td>
<td>Network Flow Theory</td>
<td></td>
</tr>
<tr>
<td>CO 353</td>
<td>Computational Discrete Optimization</td>
<td></td>
</tr>
<tr>
<td>CO 367</td>
<td>Nonlinear Optimization</td>
<td></td>
</tr>
<tr>
<td>CO 370</td>
<td>Deterministic OR Models</td>
<td></td>
</tr>
<tr>
<td>CO 372</td>
<td>Portfolio Optimization Models</td>
<td></td>
</tr>
<tr>
<td>CO 450</td>
<td>Combinatorial Optimization</td>
<td></td>
</tr>
<tr>
<td>CO 452</td>
<td>Integer Programming</td>
<td></td>
</tr>
<tr>
<td>CO 454</td>
<td>Scheduling</td>
<td></td>
</tr>
<tr>
<td>CO 456</td>
<td>Introduction to Game Theory</td>
<td></td>
</tr>
<tr>
<td>CO 463</td>
<td>Convex Optimization and Analysis</td>
<td>[A1]</td>
</tr>
<tr>
<td>CO 466</td>
<td>Continuous Optimization</td>
<td>[A1]</td>
</tr>
<tr>
<td>CO 471</td>
<td>Semidefinite Optimization</td>
<td>[A1]</td>
</tr>
<tr>
<td>CO 485</td>
<td>The Mathematics of Public-Key Cryptography</td>
<td></td>
</tr>
<tr>
<td>CO 487</td>
<td>Applied Cryptography</td>
<td></td>
</tr>
<tr>
<td>CS 341</td>
<td>Algorithms</td>
<td></td>
</tr>
<tr>
<td>CS 431</td>
<td>Data-Intensive Distributed Analytics or CS 451</td>
<td></td>
</tr>
<tr>
<td>CS 466</td>
<td>Algorithm Design and Analysis</td>
<td>[A5]</td>
</tr>
<tr>
<td>CS 476</td>
<td>Numerical Computation for Financial Modeling</td>
<td></td>
</tr>
<tr>
<td>CS 479</td>
<td>Neural Networks</td>
<td>[A1]</td>
</tr>
<tr>
<td>CS 480</td>
<td>Introduction to Machine Learning</td>
<td></td>
</tr>
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<td>CS 482</td>
<td>Computational Techniques in Biological Sequence Analysis</td>
<td></td>
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<td>CS 485</td>
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<tr>
<td>CS 487</td>
<td>Introduction to Symbolic Computation</td>
<td></td>
</tr>
<tr>
<td>PMATH 370</td>
<td>Chaos and Fractals</td>
<td></td>
</tr>
<tr>
<td>STAT 440</td>
<td>Computational Inference</td>
<td></td>
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<td>STAT 442</td>
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<td></td>
</tr>
<tr>
<td>STAT 444</td>
<td>Statistical Learning - Function Estimation</td>
<td></td>
</tr>
</tbody>
</table>

**Notes**

1. CS 341, CS 451, CS 466, CS 480, and CS 485 have restricted access for Computer Science majors are restricted to Computer Science students only. [A3]
2. CS 247 and SE 212 are restricted to Software Engineering students only.  [C3]
3. At most three courses may also be used to satisfy an explicit choice list course requirement of the student’s major. [C1]
4. For Data Science majors, at most five courses can have (or be cross-listed with courses having) a CS or STAT subject code. [C1]
5. For Computer Science majors, at most three courses can have (or be cross-listed with courses having) a CS subject code. [C2]

4 Academic Plan Changes – Minor Modifications

4.1 Combinatorics and Optimization Plan Changes

4.1.1-4.1.2 Plan Requirements for Combinatorics and Optimization
Effective Date: 01 September 2022

- Honours Combinatorics and Optimization
- Honours Joint Combinatorics and Optimization

Motion and Rationale:

Add PMATH 333 to the “Three of list” in both the Combinatorics and Optimization and Joint Combinatorics and Optimization Degree Requirements. PMATH has always offered two real analysis classes: PMATH 331 (easy difficulty) and PMATH 351 (hard difficulty). The Calendar description for PMATH 331 states "PMATH 351 may be substituted for AMATH/PMATH 331 whenever the latter is a requirement in an Honours plan." Therefore, our students have always been able to substitute PMATH 331 with PMATH 351. In 2016, PMATH added a third real analysis class: PMATH 333 (medium difficulty). Although PMATH 333 is intended as a steppingstone to allow students to take PMATH 351, by itself PMATH 333 is already a superset of PMATH 331. However, unlike PMATH 351, the Calendar does not contain any general statement allowing PMATH 333 to substitute for PMATH 331. This change amends the CO plan to allow such substitution.

(http://ugradcalendar.uwaterloo.ca/page/MATH-Combinatorics-and-Optimization2)

(http://ugradcalendar.uwaterloo.ca/page/MATH-Joint-Combinatorics-and-Optimization1)

Calendar text (to be included in FC submission but not SUC submission):

<table>
<thead>
<tr>
<th>Combinatorics and Optimization Degree Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students in this plan must fulfil all the requirements in Table 1 and Table 2. This must include at least 26 math courses and the following specific requirements:</td>
</tr>
<tr>
<td>[…]</td>
</tr>
<tr>
<td>All of PMATH 336 Introduction to Group Theory with Applications or PMATH 347 Groups and Rings</td>
</tr>
<tr>
<td>Three of MATH 237 Calculus 3 for Honours Mathematics or MATH 247 Calculus 3 (Advanced Level) AMATH 331/PMATH 331 Applied Real Analysis or PMATH 333 Introduction to Real Analysis AMATH 332/PMATH 332 Applied Complex Analysis</td>
</tr>
<tr>
<td>[…]</td>
</tr>
</tbody>
</table>

Calendar text (to be included in FC submission but not SUC submission):

<table>
<thead>
<tr>
<th>Joint Combinatorics and Optimization Degree Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>See Bachelor of Computer Science and Bachelor of Mathematics Academic Plan Combinations for a description of joint plan requirements. Note: both majors designated in such joint plans must be disciplines within the Faculty of Mathematics.</td>
</tr>
<tr>
<td>[…]</td>
</tr>
<tr>
<td>All of PMATH 336 Introduction to Group Theory with Applications or PMATH 347 Groups and Rings</td>
</tr>
<tr>
<td>Three of AMATH 331/PMATH 331 Applied Real Analysis or PMATH 333 Introduction to Real Analysis</td>
</tr>
</tbody>
</table>
4.2 Computer Science

4.2.1 Plan Titles(s): Human Computer Interaction Specialization

Effective: 01 September 2022

Motion and Rationale (as they will presented at FC and SUC): Effective 1 September 2022, add CS 480 (Introduction to Machine Learning) as an alternative to CS 485 (Statistical and Computational Foundations of Machine Learning) to the list of courses students can take. Students will still be able to take both courses if they wish, but only one will count towards the HCI specialization to ensure students take a diverse set of courses for the specialization.

(Calendar text (included in FC submission but not SUC submission):

The course requirements are the same as for the BCS, BMath, and BSE plans with the following additional requirements:

Two of

CS 445/ECE 451/SE 463 Software Requirements Specification and Analysis
CS 446/ECE 452/SE464 Software Design and Architectures
CS 447/ECE 453/SE 465 Software Testing, Quality Assurance and Maintenance
CS 454 Distributed Systems
CS 458 Computer Security and Privacy
CS 480 Introduction to Machine Learning or CS 485 Statistical and Computational Foundations of Machine Learning
CS 484 Computational Vision
CS 488 Introduction to Computer Graphics

4.3 CS 136L Impacts

Motions 4.3.1 and 4.3.2 covers a number of follow up items related to the impact of CS 136L.

UAC (February 2021), Faculty Council (April 2021), and SUC (May 2021) have approved the creation of CS 136L effective 1 September 2022. Here is the course information:

Effective 01-SEP-2022
New course: CS 136L Tools and Techniques for Software Development (0.25) LAB
Grading basis CR/NCR

Course Description: This course introduces students to tools and techniques useful in the software development lifecycle. Students learn to navigate and leverage commands and utilities in the Linux Command Line Shell. Students gain experience in Version Control Software, writing scripts to automate tasks and creating effective test cases to identify bugs. Tracing and debugging strategies are discussed.
Students also gain experience in using built-in support for version control, testing, debugging, build automation etc. in Integrated Development Environments (IDEs).

**Rationale**: In the first two years of the CS program, students take four consecutive programming-intensive courses with a strong focus on the design of algorithms and the translation of algorithms into programs. However, efficient and productive software development also requires many additional skills and best practices. Historically we expected students to pick these skills up on their own, which has not always been successful. CS136L is a lab course where these skills will be covered. Refer to the supporting document for more details.

### 4.3.1 Corrective Motion on effective date for changes to CS 241, CS 241E, CS 246, and CS 246E

**Effective Date**: 1 September 2023

**Motion and Rationale**: The May 2021 SUC saw an approval of new course CS 136L and a modification of the prerequisites of CS 241, CS 241E, CS 246, and CS 246E to include CS 136L, all effective 1 September 2022. With this setup, no students will be able to take the 2nd year classes in fall 2022 without advisor override. The intention was in fact to stagger these changes, with CS 136L being created effective 2022 and the modification of the prerequisites effective 1 September 2023.

### 4.3.2 Implementation of bi-directional corequisites for CS 136L

**Effective Date**: 1 September 2022

The following motions in this section of the agenda represent the impacts of CS 136L being a two-way corequisite with CS 136. In the undergraduate calendar a two-way co-requisite will exist for (CS 136 and CS 136L) and (CS 146 and CS 136L). Students will be informed that they need to add both courses at the same time in Quest. In practice, the coding for the lectures (CS 136 and CS 146) will be applied but the coding for the lab (CS 136L) will be removed. There is the potential that a student could enrol into the lab without the lecture; it is the responsibility of the faculty to identify these students. (Consultation with Jo Voisin and Sheila Brubacher – July 2021)

Computer Science Plan Title(s):

- Honours Computer Science
- Honours Joint Computer Science
- Computer Science Minor
- Double Degree: Business Administration and Computer Science
- Honours Computing and Financial Management

**4.3.2 Motion and Rationale**: Modify the plans where CS 136 or 146 are mandatory requirements by adding CS 136L as another mandatory requirement alongside CS 136 and CS 146. SUC approved the creation of CS 136L at its May 11, 2021, meeting with CS 136 and CS 146 as corequisites effective September 1, 2022. At the April 26, 2021, UAC meeting, we approved changes to CS 136 and CS 146 to have CS 136L as a corequisite effective September 1, 2022; this will be submitted to SUC at the October 2021 meeting. This two-way corequisite creates the implementation issue outlined above. For plans where CS 136 or 146 are
mandatory requirements, the calendar will be modified effective 1 September 2022 to indicate to students that CS 136L must be taken and passed. The affected pages are:

2. Computer Science Degree requirements: http://ugradcalendar.uwaterloo.ca/page/MATH-Bachelor-of-Computer-Science-1
7. Bachelor of Math Data Science: http://ugradcalendar.uwaterloo.ca/page/MATH-Data-Science1

Note: All program committees and departments have approved these changes. Arts has also been consulted. WLU has also been consulted and will update their calendar accordingly.

4.3.3 Affected Calendar Pages

Computer Science Admissions Page
(http://ugradcalendar.uwaterloo.ca/page/MATH-Computer-Science-Admissions)

Calendar text (to be included in FC submission but not SUC submission):

<table>
<thead>
<tr>
<th>Students from within the Faculty of Mathematics with advanced standing may apply for admission to a Computer Science major plan if they:</th>
</tr>
</thead>
<tbody>
<tr>
<td>[…]</td>
</tr>
<tr>
<td>Have credit for (CS 136 or CS 146), and CS 136L</td>
</tr>
<tr>
<td>[…]</td>
</tr>
</tbody>
</table>

Bachelor of Computer Science
(http://ugradcalendar.uwaterloo.ca/page/MATH-Bachelor-of-Computer-Science-1)

Calendar text (to be included in FC submission but not SUC submission):

| […] |
| All of |
| CS 136L Tools and Techniques for Software Development |
| CS 240 Data Structures and Data Management |
| CS 241 Foundations of Sequential Programs |
| CS 245 Logic and Computation |
| CS 246 Object-Oriented Software Development |
CS 251 Computer Organization and Design
CS 341 Algorithms
CS 350 Operating Systems

Joint Bachelor of Computer Science
(http://ugradcalendar.uwaterloo.ca/page/MATH-Joint-Bachelor-of-Computer-Science-1)

Calendar text (to be included in FC submission but not SUC submission)

Joint Bachelor of Computer Science
[...]
All of
CS 136L Tools and Techniques for Software Development
CS 240 Data Structures and Data Management
CS 241 Foundations of Sequential Programs
CS 245 Logic and Computation
CS 246 Object-Oriented Software Development
CS 251 Computer Organization and Design
CS 341 Algorithms
CS 350 Operating Systems
[...]

Computer Science Minor Change related to CS 136L Motion
(http://ugradcalendar.uwaterloo.ca/page/MATH-Computer-Science-Minor-2)

Calendar text (to be included in FC submission but not SUC submission):

[...]
A minimum of 4.25 CS course credits including:
One of
  CS 136 Elementary Algorithm Design and Data Abstraction
  CS 146 Elementary Algorithm Design and Data Abstraction (Advanced Level)

  CS136L Tools and Techniques for Software Development

One additional course from CS 340-CS 398, CS 440-CS 498.

[...]

Computing Minor Change related to CS 136L Motion
(http://ugradcalendar.uwaterloo.ca/page/MATH-Computing-Minor)

Calendar text (to be included in FC submission but not SUC submission):

[...]
One of
  CS 116 Introduction to Computer Science 2
  CS 136 Elementary Algorithm Design and Data Abstraction and CS136L Tools and Techniques for Software Development
  CS 146 Elementary Algorithm Design and Data Abstraction (Advanced Level) and CS136L Tools and Techniques for Software Development

One additional CS course from CS 100-CS 146, CS 200-CS 299, CS 300-CS 398, CS 400-CS 498.

Double Degree Program Related CS 136L motion
(http://ugradcalendar.uwaterloo.ca/page/MATH-Bus-Admin-Computer-Sci-Double-Degree-Reqmnt-1)

Calendar text (to be included in FC submission but not SUC submission):

[...]
  All of
  CS 136L Tools and Techniques for Software Development
  CO 250 Introduction to Optimization
  CS 240 Data Structures and Data Management
  CS 241 Foundations of Sequential Programs
  CS 245 Logic and Computation
  CS 246 Object-Oriented Software Development
  CS 251 Computer Organization and Design
  CS 341 Algorithms
  CS 350 Operating Systems
[...]

Statistics and Actuarial Science related CS 136L motion
(http://ugradcalendar.uwaterloo.ca/page/MATH-Data-Science1)

Calendar text (to be included in FC submission but not SUC submission):

[...]

This plan has the same requirements as Honours Statistics with the following additional requirements:

One of
  CS 136 Elementary Algorithm Design and Data Abstraction and CS 136L Tools and Techniques for Software Development
  CS 146 Elementary Algorithm Design and Data Abstraction (Advanced Level) and CS 136L Tools and Techniques for Software Development
[...]
Computing and Financial Management related CS 136L motion
(https://ugradcalendar.uwaterloo.ca/page/MATH-Computing-Financial-Mngt-Overview-Degree-Req)

Calendar text (to be included in FC submission but not SUC submission):

[...]
All of
CS 136L Tools and Techniques for Software Development
CS 240 Data Structures and Data Management
CS 241 Foundations of Sequential Programs
CS 245 Logic and Computation
[...]

4.3.4 Issues considered by UAC for Motion 4.3.2

UAC considered a range of possible issues in the creation of CS 136L and the impacts it may have. The following information represents the discussions at UAC meetings.

Contextual Information adapted from Computer Science Proposal and UAC minutes

At the February 22nd, 2021 Undergraduate Affairs Committee, Computer Science proposed CS 136L as a new course. The rationale is that the knowledge acquired in CS136L is essential for a successful programmer. In the past, we have expected students to pick up these skills on their own. The course will provide content that students can use throughout their undergraduate studies and use it as a reference during their coop placements. An additional benefit will be easing the transition for computer science majors into second year and allowing the Object-Oriented Programming course to regain focus on the subject it is meant to teach.

Consider that undergraduate computer science majors take four consecutive programming-intensive courses in the span of the first two years. In first year, the focus is on the design of algorithms and the translation of these algorithms into programs. However, efficient and productive software development requires a programmer to learn many soft skills that are usually learned through experience. Currently, the 2A course, CS246 (Object-Oriented Software Development) takes on the task of introducing students to these skills (writing scripts for automation, using memory error detectors and debuggers, separate compilation, build automation etc.). This results in valuable time taken away from the primary purpose of the course; an introduction to object-oriented programming which in itself is a vast field.

Splitting the focus of the course leads to a superficial treatment of most course content. Additionally, this transition from a sheltered software development environment in first year to a more real-world environment in second year comes as a shock to many students. The disconnect adds to student struggles in second year and some never recover.

There is general consensus that students should be taught these practical programming soft skills but it has been hard to find a spot for them. However, there is a need for these skills and to be introduced sooner rather than later. This is especially true for our computer science coop students who are expected to know things like version control software, debuggers, writing scripts etc. at their coop placements. Since the skills we aim to impart are best learned through hands-on experience, rather than lecture-style delivery, CS136L
will be a 0.25 credit lab course taken alongside CS136. Students will be expected to come prepared after reading required readings and/or watching prepared videos. During the lab, students will work through crafted activities to complete tasks that exercise the content being taught in CS 136.

**Impact on students enrolled in multiple terms in a row (under bidirectional coreq)**

We must plan for a path forward for those students who may fail CS 136L in their 1B but would take a subsequent course immediately in the spring. They would not have spring to redo CS36L while on coop for instance.

**Dropping or failing CS 136L**

Faculty council has now agreed that CS136L has CS136|146 as a corequisite. The motion in front of us asks to also have CS136L as a corequisite of CS136|146.

If CS136L is bilateral coreq with CS136|146 then dropping one drops the other. It would be thus impossible for someone doing well in one but bad in the other to WD one only.

However, if one fails one but not the other, they could retake the failed course later.

**Double Degree Implications**

During our February 22, 2021 UAC meeting, we considered the implication of CS 136L for Double Degree (DD) students due to the limited opportunities for students to take 3.0 units or 6 courses. We wondered if CS 136L would cause issues for students in the DD program.

Keep in mind that any student, including Double Degree students, with a CAV above 80 may take up to 2.75 units without special permission; this is in the undergraduate calendar. Students who have a cumulative average of 80% or more and are in Excellent standing have a maximum course load of 3.25 units.

For Double Degree students with a CAV between 70 and 80, those students can be overridden into 6 courses two times during their study. Since the students must complete their 1st communications course (in addition to math and bus core) in their 1B term, most of those students use one of their two overloaded terms in 1B. The additional 0.25 credit for CS 136L should still fit with BBA/BCS students who want to overload in 1B, at least from UW’s perspective. When our RO sets the unit load to permit 6 courses, they set it to 3.25 units. This will permit 6 half-credit courses plus 0.25 for CS 136L. In a normal term, the RO sets the unit load to 2.75 units. This permits 5 half-credit courses plus 0.25 for some other course.

**Tuition Summary**

Undergraduate students are charged a dollar amount per course until a maximum tuition is reached. This maximum tuition is outlined by the Finance department and made public on its website (https://uwaterloo.ca/finance/student-financial-services/tuition-fee-schedules). Maximum tuition is charged when a student takes 2.5 units of courses in a term. For example, the maximum tuition for a Faculty of Mathematics undergraduate Canadian student not in co-op for Spring 2021 is $3064.00 when 2.5 units of undergraduate courses are taken. Beyond 2.5 units, there is no charge for additional courses or labs. The maximum tuition is important to note in understanding the impact of CS 136L becoming a co-requisite to CS 136 and CS 146.

In the Faculty of Mathematics, there are several plans with higher tuition costs. In Table 1 and 2 below, these higher tuition plans are outlined along with the number of their students who have taken either CS 136 or CS 146. Table 1 and 2 are important because they are outlining the number of students who would
have paid for CS 136L if it was a corequisite to CS 136|146. Looking at Table 1 for example, in Fall 2019, 52 students enrolled in CS 136|146 from these higher tuition programs for CS 136L if it was a corequisite. These 52 students would pay for CS 136L because they only took 0.5–2.25 units in Fall 2019. For information about the number of students who took CS 136|146 in relation to the number of courses enrolled in a term or those on co-op who took CS 136, see Table 3.

**Table 1**

<table>
<thead>
<tr>
<th>Assumption: All Students are International Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TUITION CATEGORY - PROGRAM/PLAN</strong></td>
</tr>
<tr>
<td>Fall 2019</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>(0.5 – 2.25 units)</td>
</tr>
<tr>
<td>UMA01(CS) &amp; UMA02(MATH) - Double Degree (Waterloo based)</td>
</tr>
<tr>
<td>UMA 05(CS) &amp; UMA 06(MATH) - Double Degree (Laurier based)</td>
</tr>
<tr>
<td>UMA 20 - Math/CPA</td>
</tr>
<tr>
<td>UMA 20 &amp; UMA 25 - Math/FARM</td>
</tr>
<tr>
<td>UMA 20 &amp; UMA 25 - Math</td>
</tr>
<tr>
<td>UMA 10 &amp; UMA 15 - CS</td>
</tr>
<tr>
<td>UID 30 - CFM</td>
</tr>
<tr>
<td>TOTAL (0.5 - 2.25 units)</td>
</tr>
<tr>
<td>TOTAL ENROLLED</td>
</tr>
<tr>
<td>PERCENTAGE</td>
</tr>
</tbody>
</table>

**Table 1**

<table>
<thead>
<tr>
<th>Assumption: All Students are Domestic Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TUITION CATEGORY - PROGRAM/PLAN</strong></td>
</tr>
<tr>
<td>Fall 2019</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>(0.5 – 1.75 units)</td>
</tr>
<tr>
<td>UMA01(CS) &amp; UMA02(MATH) - Double Degree (Waterloo based)</td>
</tr>
<tr>
<td>UMA 05(CS) &amp; UMA 06(MATH) - Double Degree (Laurier based)</td>
</tr>
<tr>
<td>UMA 20 - Math/CPA</td>
</tr>
<tr>
<td>UMA 20 &amp; UMA 25 - Math/FARM</td>
</tr>
<tr>
<td>UMA 20 &amp; UMA 25 - Math</td>
</tr>
<tr>
<td>UMA 10 &amp; UMA 15 - CS</td>
</tr>
<tr>
<td>UID 30 - CFM</td>
</tr>
<tr>
<td>TOTAL (0.5 - 1.75 units)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>COOP - Units taken in term</td>
</tr>
<tr>
<td>0.50</td>
</tr>
<tr>
<td>1.00</td>
</tr>
<tr>
<td>1.50</td>
</tr>
<tr>
<td>2.00</td>
</tr>
<tr>
<td>TOTAL</td>
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<table>
<thead>
<tr>
<th>FORM OF STUDY</th>
<th>Fall 2019</th>
<th>Winter 2020</th>
<th>Spring 2020</th>
<th>Fall 2020</th>
<th>Winter 2021</th>
<th>Spring 2021</th>
<th>TOTAL</th>
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</thead>
<tbody>
<tr>
<td>ENROLLMENT - Units taken in term</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50</td>
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<td></td>
<td>15</td>
</tr>
<tr>
<td>1.00</td>
<td>14</td>
<td>2</td>
<td>4</td>
<td>19</td>
<td></td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>1.50</td>
<td>10</td>
<td>9</td>
<td>14</td>
<td>29</td>
<td>18</td>
<td></td>
<td>116</td>
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<tr>
<td>1.75</td>
<td>10</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2.00</td>
<td>42</td>
<td>66</td>
<td>49</td>
<td>120</td>
<td>43</td>
<td></td>
<td>360</td>
</tr>
<tr>
<td>2.25</td>
<td>4</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>52</td>
<td>81</td>
<td>102</td>
<td>57</td>
<td>156</td>
<td>89</td>
<td>537</td>
</tr>
</tbody>
</table>

**Table 3**

### Other Faculties 2019 - 2021

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEALTH</td>
<td>4</td>
</tr>
<tr>
<td>ARTS</td>
<td>18</td>
</tr>
<tr>
<td>ENG</td>
<td>4</td>
</tr>
<tr>
<td>ENV</td>
<td>16</td>
</tr>
<tr>
<td>SCI</td>
<td>47</td>
</tr>
<tr>
<td>TOTAL</td>
<td>89</td>
</tr>
</tbody>
</table>

**Table 4**

CS 136|146 in various programs
This captures all the graduates in plan groups in 2020. Note that there are some double counting.

<table>
<thead>
<tr>
<th>plan group id</th>
<th>total</th>
<th>passed</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>uw.u.math.bac.amath</td>
<td>33</td>
<td>15</td>
<td>45</td>
</tr>
<tr>
<td>uw.u.math.bac.co</td>
<td>60</td>
<td>40</td>
<td>67</td>
</tr>
<tr>
<td>uw.u.math.bac.compmath</td>
<td>64</td>
<td>59</td>
<td>92</td>
</tr>
<tr>
<td>uw.u.math.bac.cs</td>
<td>711</td>
<td>676</td>
<td>95</td>
</tr>
<tr>
<td>uw.u.math.bac.math</td>
<td>8</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>uw.u.math.bac.math3g</td>
<td>44</td>
<td>24</td>
<td>55</td>
</tr>
<tr>
<td>uw.u.math.bac.mathbus</td>
<td>327</td>
<td>67</td>
<td>20</td>
</tr>
<tr>
<td>uw.u.math.bac.mathstudies</td>
<td>88</td>
<td>39</td>
<td>44</td>
</tr>
<tr>
<td>uw.u.math.bac.pmath</td>
<td>44</td>
<td>33</td>
<td>75</td>
</tr>
<tr>
<td>uw.u.math.bac.statactsc.actsc</td>
<td>160</td>
<td>38</td>
<td>24</td>
</tr>
<tr>
<td>uw.u.math.bac.statactsc.datasci</td>
<td>16</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>uw.u.math.bac.statactsc.mathfin</td>
<td>28</td>
<td>12</td>
<td>43</td>
</tr>
<tr>
<td>uw.u.math.bac.statactsc.stats</td>
<td>419</td>
<td>168</td>
<td>40</td>
</tr>
<tr>
<td>uw.u.math.bac.teach</td>
<td>6</td>
<td>2</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 5

4.4 Statistics and Actuarial Science

4.4.1 Plan Title: Mathematical Finance Degree Requirement

Effective 1 September 2022

Motion and Rationale: Effective 1 September 2022, the following changes are being made to the Mathematical Finance plan:

- Add PMATH 333 as a degree requirement. This change clarifies what students must actually take in order to meet the prerequisites of the required PMATH 351 course that exists in the ‘All of’ list. In more detail: the required course PMATH 351 has for its requisites MATH 247 or PMATH 333; students who opt to take PMATH 333 must also take MATH 237 since it is a corequisite to PMATH 333.
- Add CO 255 (Intro to Optimization, Advanced) as an alternative to CO 250 (Intro to Optimization).
- Add AMATH 251 (Intro to Differential Equations, Advanced Level) as an alternative to AMATH 250 (Intro to Differential Equations).

The Calendar description of both AMATH 250 and CO 250 state that they may be substituted for the regular versions whenever the latter are a requirement in an Honours plan. Adding the information to the plan simplifies advising.


Calendar text (included in FC submission but not SUC submission):
The Mathematical Finance plan is offered jointly by the departments of Statistics and Actuarial Science and of Pure Mathematics. Students in this plan must fulfil all the requirements in Table 1 and Table 2. This must include at least 26 math courses and the following specific requirements:

MATH 247 or (MATH 237 and PMATH 333)

All of
- AFM 101 Introduction to Financial Accounting or BUS 127W Introduction to Financial Accounting
- AFM 102 Introduction to Managerial Accounting or BUS 247W Managerial Accounting
- AFM 131/ARBUS 101 Introduction to Business in North America or BUS 111W Understanding the Business Environment
- ACTSC 231 Introductory Financial Mathematics
- ACTSC 372 Investment Science and Corporate Finance
- ACTSC 445 Quantitative Enterprise Risk Management
- ACTSC 446 Mathematics of Financial Markets
- AMATH 242/CS 371 Introduction to Computational Mathematics or CS 335 Computational Methods in Business and Finance
- AMATH 250 Introduction to Differential Equations or AMATH 251 Introduction to Differential Equations (Advanced Level) or AMATH 350 Differential Equations for Business and Economics
- […]
- One of
  - AMATH 351 Ordinary Differential Equations 2
  - CO 250 Introduction to Optimization or CO 255 Introduction to Optimization (Advanced Level)
  - PMATH 352 Complex Analysis
- One of
  - AMATH 353 Partial Differential Equations 1
  - CO 372 Portfolio Optimization Models
  - CS 476 Numeric Computation for Financial Modeling
  - PMATH 453 Functional Analysis
- […]

4.4.2-4.4.4 Statistics and Actuarial Science Plan Changes

Effective Date: 01 September 2022

Motion and Rationale: Effective 1 September 2022, AMATH 251 and AMATH 350 are added as alternatives to AMATH 250 in:

- Actuarial Science
- Statistics
- Biostatistics

AMATH 251 is the advanced version of AMATH 250. The current language allows some students in Business-related programs to make the AMATH 350 substitution. The prerequisite list for AMATH 350 mostly restricts enrollment in this course and explicitly listing it as an option will decrease confusion.

Calendar text (included in FC submission but not for SUC, additions in blue, deletion in red):

Statistics

Students in this plan must fulfil all the requirements in Table 1 and Table 2. This must include at least 26 math courses and the following specific requirements:

[…]

One of

MATH 239 Introduction to Combinatorics
MATH 249 Introduction to Combinatorics (Advanced Level)
AMATH 231 Calculus 4
AMATH 242/CS 371 Introduction to Computational Mathematics
AMATH 250 Introduction to Differential Equations
AMATH 251 Introduction to Differential Equations (Advanced Level)
AMATH 350 Differential Equations for Business and Economics

Two 400-level STAT courses.

[…]

Notes

1. For Statistics majors, including Data Science majors, currently or previously enrolled in the following plans (Business Administration and Mathematics double degree, Mathematics/Business Administration, Mathematics/Financial Analysis and Risk Management, Information Technology Management, and Mathematical Optimization – Business Specialization) may substitute:
   a. STAT 371 for STAT 331.
   b. STAT 372 for STAT 332.
   c. AMATH 350 for AMATH 250.

2. […]

Calendar text (included in FC submission but not for SUC, additions in blue, deletion in red):

Biostatistics

Students in this plan must fulfil all the requirements in Table 1 and Table 2. This must include at least 26 math courses and the following specific requirements:

[…]

One of
AMATH 231 Calculus 4  
AMATH 242/CS 371 Introduction to Computational Mathematics  
AMATH 250 Introduction to Differential Equations  
AMATH 251 Introduction to Differential Equations (Advanced Level)  
AMATH 350 Differential Equations for Business and Economics  
MATH 239 Introduction to Combinatorics  
MATH 249 Introduction to Combinatorics (Advanced Level)

[...]

Notes

1. Students currently or previously enrolled in the following plans (Business Administration and Mathematics double degree, Mathematics/Business Administration, Mathematics/Financial Analysis and Risk Management, Information Technology Management, and Mathematical Optimization – Business Specialization) may substitute:
   a. STAT 371 for STAT 331.
   b. STAT 372 for STAT 332.
   c. AMATH 350 for AMATH 250.

2. [...]

Calendar text (included in FC submission but not for SUC, additions in blue, deletion in red):

Actuarial Science
Students in this plan must fulfil all the requirements in Table 1 and Table 2. This must include at least 26 math courses and the following specific requirements:

One of
MATH 237 Calculus 3 for Honours Mathematics  
MATH 247 Calculus 3 (Advanced Level)

One of
AMATH 250 Introduction to Differential Equations  
AMATH 251 Introduction to Differential Equations (Advanced Level)  
AMATH 350 Differential Equations for Business and Economics

All of
[...]
ACTSC 446 Mathematics of Financial Markets  
AMATH 250 Introduction to Differential Equations  
ECON 101 Introduction to Microeconomics

[...]

Notes

2. Students currently or previously enrolled in the following plans (Business Administration and Mathematics double degree, Mathematics/Business Administration, Mathematics/Financial Analysis and Risk Management, Information Technology Management, and Mathematical Optimization – Business Specialization) may substitute:
   - AMATH 350 for AMATH 250.
4.5 Dean of Mathematics Plan Changes

4.5.1 Plan Title(s): Bachelor of Mathematics Three Year General Degree (Honours Fallback Provision)

Effective Date: 01 September 2022

Background and rationale: Effective 1 September 2022, remove language referring to the return of 3 Year Degree (honours fallback provision) in the notes section when students wish to upgrade to an Honours degree. Such language was in place to be consistent with other faculties and those faculties have since deleted the language. Furthermore, the 3 Year Degree is different than the Honours degree and students should be able to keep both.

(http://ugradcalendar.uwaterloo.ca/page/MATH-Degree-Requirements-for-Math-students)

Calendar Text (included in FC submission but not SUC submission):

Notes
1. Graduates who were previously awarded a general degree may apply for readmission to upgrade to an honours degree. These applications will be considered on a case-by-case basis. Students wishing an upgrade are required to return the earlier degree in order to be granted the upgraded degree. Courses and grades from the general degree would be used towards the upgraded degree if applicable, but students would otherwise need to meet current Calendar requirements.
2. Students choosing the Honours Fallback Provision may not combine this choice with any specialization, option, or minor.

4.5.2 Plan Title(s): Specific Plans shown below in the Admission to Specific Honours Academic Plans section

Effective Date: 1 September 2022

Motion and Rationale: Effective 1 September 2022. The Faculty of Mathematics calendar has one page describing the admission to specific honours academic plans. The Applied Mathematics/Engineering Specialization plan is marked as limited enrolment on the plan page, but not on this page. The Bachelor of Computing and Financial Management (BCFM) Steering Committee, in consultation with the faculties of Arts and Mathematics, and their admission committees, determines admission requirements for the BCFM program. The details are listed on a page outside the calendar, but there is no mention of them on this page. Another page, the Faculty policies page, has a table that indicates major averages required of students in various majors. Adding the information about those limited enrolment plans and a statement to the effect that students must meet the Major Average Requirement of the plan they want to join as stated in the Faculty Policies section would avoid confusion on the part of students and simplify the work of advisors.

URL: http://ugradcalendar.uwaterloo.ca/page/MATH-Admission-Specific-Honours-Academic-Plans

Calendar text (included in FC submission but not in SUC submission)
1. To be admitted in a specific honours plan, students must satisfy the minimum major average of the plan they want to enter as written in the Faculty policies page of the calendar.

2. The following plans are limited enrolment plans:
   - Actuarial Science (all plans)
   - Applied Mathematics / Engineering Specialization
   - Biostatistics
   - Business Administration and Computer Science Double Degree
   - Business Administration and Mathematics Double Degree
   - Computer Science
   - Computing and Financial Management
   - Data Science (all plans)
   - Financial Analysis and Risk Management
   - Information Technology Management
   - Mathematics/Business Administration
   - Mathematics/Chartered Professional Accountancy (all plans)
   - Mathematics/Teaching
   - Software Engineering

3. Students are not admitted to specific honours plans before their 2A term, except for the following plans:
   - Business Administration and Mathematics Double Degree
   - Computer Science (all major plans)
   - Financial Analysis and Risk Management
   - Information Technology Management
   - Mathematics/Business Administration
   - Mathematics/Chartered Professional Accountancy (all plans)

4. Students are normally admitted to Software Engineering in Year One.

5. [Note about Actuarial Science]

6. [Note about BMATH(Data Science) and BCS(Data Science)]

Other calendar extract for context (included in FC submission but not SUC submission)


**Admissions**

The Bachelor of Computing and Financial Management (BCFM) Steering Committee, in consultation with the faculties of Arts and Mathematics, and their admission committees, determines admission requirements for the BCFM program.

Minimum admission requirements are those of the Faculty of Mathematics, with admissions to the BCFM program handled by the Mathematics admissions committee, following policies set by the BCFM Steering Committee.

English language requirements are those of the Faculty of Arts. Students will be required to have a minimum of 75% in English 4U (grade 12 university level) or equivalent.

http://ugradcalendar.uwaterloo.ca/page/MATH-AM-Engineering-Specialization
5 Information

5.1 Also offered Online vs Remote; April 26, 2021

Context: One important debate was suspended when the pandemic has hit us. Prior to the pandemic, if a unit want to offer a course online, this would be debated. The label “also offered online” was only added after a number of approvals: program committee, department, UAC, SUC, Senate. This generated profound debates.

The article “In the defence of the classroom” (https://notes.math.ca/archives/Notesv47n6.pdf) in the December 2015 issue of the Notes of the CMS illustrates the debate that should have happened but did not. It was written by CMS Vice-President of Ontario and Waterloo Pure Math Professor Rahim Moosa.

When the pandemic hit us, we had no choice as an institution but to allow everything to be offered online. We kept tracks through the interesting distinction of “remote” (sections 041, 042, etc) and “online” (sections 081, 082, etc). There is also considerable thought being given to blended learning. We anticipate that there will be interest in (and benefit from) using the extensive resources that have been developed for some current remote courses to ongoing, fully online offerings. CEL has been given additional resources by the Provost to facilitate such transitions. In initial discussions at UOps, we realize we need to make a meta decision on how do we move forward as an institution.

Notes of UAC discussion on the topic (taken from the minutes):

- This discussion was a start in considering what our faculty could do after the pandemic when thinking of labeling courses as online courses.
- To add TUT or TST components requires an approval process; so we could have an approval process if a course is offered online versus remote. Further, from a resource perspective, CEL needs to be asked if they can support online course attributes like midterms and exams. Additionally, independently proctored in-person exams can be very expensive and require a high number of human resources.
- Mode of delivery of courses are an important aspect when considering academic integrity issues.
- PM, AM, CO expressed a desire to continue the debate per course. There is a recognition that we do have an established framework for on campus courses (physical space for classes and exams, etc). A move to a model where all courses can be put online would require the University to have a framework in place.
- Double Degree issue in that Laurier pays UWaterloo different amounts based on online vs in-person classes.
- A positive outcome of the pandemic will be that students suffer fewer scheduling conflicts due to synchronous physical lectures. Hopefully having some courses with video lecture content for some courses will reduce scheduling pressure. A few questions to consider: 1) Is there UW-specific data
about the comparative success of online/non-online version of courses? 2) Do students in online course X do better in course for which X is a prerequisite than the ones that took X in person.

**Next steps:** If you have opinions or recommendations of how we proceed in the future, please send them to the ADUG at math.ug.ad@uwaterloo.ca.