UNIVERSITY OF
TORONTO
SCARBOROUGH

**FOR APPROVAL**  **PUBLIC**  **OPEN SESSION**

**TO:** UTSC Academic Affairs Committee

**SPONSOR:** Prof. William Gough, Vice-Principal Academic and Dean
**CONTACT INFO:** 416-208-7027, vpdean.utsc@utoronto.ca

**PRESENTER:** Prof. Katherine Larson: Vice-Dean Teaching, Learning & Undergraduate Programs
**CONTACT INFO:** (416) 208-2978, vdundergrad.utsc@utoronto.ca

**DATE:** April 20, 2021 for April 27, 2021

**AGENDA ITEM:** 9

**ITEM IDENTIFICATION:**

Minor Modifications: Undergraduate Curriculum Changes – Sciences, UTSC

**JURISDICTIONAL INFORMATION:**

University of Toronto Scarborough Academic Affairs Committee (AAC) "is concerned with matters affecting the teaching, learning and research functions of the Campus" (*AAC Terms of Reference, Section 4*). Under section 5.6 of its terms of reference, the Committee is responsible for approval of "Major and minor modifications to existing degree programs." The AAC has responsibility for the approval of Major and Minor modifications to existing programs as defined by the University of Toronto Quality Assurance Process (*UTQAP, Section 3.1*).

**GOVERNANCE PATH:**

1. **UTSC Academic Affairs Committee [For Approval] (April 27, 2021)**

**PREVIOUS ACTION TAKEN:**

No previous action in governance has been taken on this item.

**HIGHLIGHTS:**

This package includes minor modifications to undergraduate curriculum, submitted by the UTSC Sciences academic units identified below, which require governance approval. Minor modifications to curriculum are understood as those that do not have a significant impact on program or course learning outcomes. They require governance approval when they modestly change the nature of a program or course.

- The Department of Computer and Mathematical Sciences (Report: Computer and Mathematical Sciences)
  - 11 program changes
    - Specialist Program in Mathematics
    - Specialist (Co-operative) Program in Mathematics
    - Specialist Program in Computer Science
    - Specialist (Co-operative) Program in Computer Science
    - Major Program in Computer Science
    - Major (Co-operative) Program in Computer Science
    - Minor Program in Computer Science
    - Major Program in Mathematics
    - Major (Co-operative) Program in Mathematics
    - Major Program in Statistics
    - Major Program (Co-operative) in Statistics
  - 1 new course
    - CSCD25H3

- The Department of Physical and Environmental Sciences (Report: Physical and Environmental Sciences)
  - 4 new courses
    - PHYC14H3
    - EESC38H3
    - ESTC38H3
    - EESD31H3
  - 2 course changes
    - EESD09H3
    - EESD10H3

## FINANCIAL IMPLICATIONS:

There are no net implications to the campus operating budget.

## RECOMMENDATION:

Be It Resolved,

THAT the proposed Sciences undergraduate curriculum changes for the 2021-22 academic year, as detailed in the respective curriculum reports, be approved.

**DOCUMENTATION PROVIDED:**

1.  2021-22 Curriculum Cycle: Undergraduate Minor Curriculum Modifications for Approval Report: Computer and Mathematical Sciences, dated March 29, 2021.

2.  2021-22 Curriculum Cycle: Undergraduate Minor Curriculum Modifications for Approval Report: Physical and Environmental Sciences, dated March 26, 2021.

**2021-22 Curriculum Cycle**
**Undergraduate Minor Curriculum Modifications for Approval**
**Report: Computer and Mathematical Sciences**
March 29, 2021

## Computer & Mathematical Sciences (UTSC), Department of

# 11 Minor Program Modifications:

## MAJOR (CO-OPERATIVE) PROGRAM IN COMPUTER SCIENCE (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Major ( Co-operative ) Program in Computer Science is limited.

*Current Co-op Students:*
Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits. Students ~~and~~ must have completed ~~passed~~ ~~all~~ ~~of~~ the required A-level CSC and MAT courses ~~required in the program ( CSCA08H3 , CSCA48H3 , CSCA67H3 , MATA22H3 , MATA31H3 ,~~ and ~~MATA37H3 )~~
~~. Students are admitted on the basis of academic performance in program courses; for more information about the admission requirements , please visit the following CMS webpage . In addition~~
~~, they must also have~~ achieved the required grades ~~a CGPA of at least 2.5 across all attempted courses~~
~~.~~
~~Students who are not admitted as above~~ , described ~~and who are enrolled~~ in
the Enrolment Requirements for the Major ~~Minor~~ in Computer Science
~~; may apply after completing at least 7.5 credits , including the core A-~~
~~level courses listed above as well as CSCB07H3 * , CSCB09H3 * , CSCB36H3 *~~
~~, and at least one of MATB24H3 or STAB52H3~~
~~. Students are admitted on the basis of academic performance in program courses; for more information about the admission requirements , please visit the following CMS webpage~~ . In addition, they must also have achieved a CGPA of at least 2.5 across all attempted ~~courses .~~
~~* These~~ courses ~~have a CS subject POSt or minimum CGPA prerequisite~~ .

*Prospective Co-op Students:*
Prospective students (i.e., those not yet admitted to a Co-op Degree POSt) must meet the enrolment requirements noted above and have a CGPA of at least 2.75 across all attempted courses.

Students must submit a program request on ACORN. Deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each year. Failure to submit the program request on ACORN will result in the student's application not being considered.

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
 Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.
The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.
The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
 New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process

were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**

Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# MAJOR (CO-OPERATIVE) PROGRAM IN MATHEMATICS (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Major (Co-operative) Program in Mathematics is limited.

*Current Co-op Students:*
Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits. Students ~~and~~ must have completed ~~passed~~ ~~all~~ ~~of~~ the required A-level CSC and MAT courses ~~required in the program (CSCA08H3, CSCA67H3 / MATA67H3, MATA22H3, MATA31H3~~ and achieved ~~MATA37H3).~~ ~~Students are admitted on~~ the required grades, described ~~basis of academic performance~~ in ~~program courses; for more information about~~ the Enrolment Requirements for ~~admission requirements, please visit~~ the Major in Mathematics ~~following CMS webpage~~. In addition, they must also have achieved a CGPA of at least 2.5 across all attempted courses.

*Prospective Co-op Students:*
Prospective students (i.e., those not yet ~~already~~ admitted to a Co-op Degree POSt) ~~may apply to the Co-op Program after completing 4.0 credits, and~~ must meet ~~have passed all of the A-level CSC and MAT courses required in the program (CSCA08H3, CSCA67H3 / MATA67H3, MATA22H3, MATA31H3 and MATA37H3)~~ ~~. Students are admitted on the basis of academic performance in program courses; for more information about~~ the enrolment ~~admission~~ requirements noted above and ~~, please visit the following CMS webpage. In addition, they must also~~ have ~~achieved~~ a CGPA of at least 2.5 across all attempted courses.

Students must submit a program request on ACORN. Deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each year. Failure to submit the program request on ACORN will result in the student's application not being considered.

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
 Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More

recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.

Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.

The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.

The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# MAJOR (CO-OPERATIVE) PROGRAM IN STATISTICS (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Major (Co-operative) Program in Statistics is limited.

*Current Co-op Students:*
Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits. Students ~~and~~ must have passed ~~all of~~ the required A-level CSC and MAT courses ~~required in the program ({CSCA08H3 or CSCA20H3}, MATA22H3, {MATA30H3 or MATA31H3}~~, and achieved ~~{MATA36H3 or MATA37H3})~~

. ~~Students are admitted on~~ the required grades, described ~~basis of academic performance~~ in ~~program courses; for more information about~~ the Enrolment Requirements for ~~admission requirements,~~ ~~please visit~~ the Major in Statistics ~~following CMS webpage~~ . In addition, they must also have achieved a CGPA of at least 2.5 across all attempted courses.

*Prospective Co-op Students:*
 Prospective students (i.e., those not yet ~~already~~ admitted to a Co-op Degree POSt) ~~may apply to the Co-op Program after completing 4.0 credits,~~ ~~and~~ must meet ~~have passed all of the A-level CSC and MAT courses required in the program ({CSCA08H3 or CSCA20H3}, MATA22H3, {MATA30H3 or MATA31H3}, and {MATA36H3 or MATA37H3})~~
~~. Students are admitted on the basis of academic performance in program courses; for more information about~~ the enrolment ~~admission~~ requirements noted above and
~~, please visit the following CMS webpage . In addition,~~ ~~they must also~~ have ~~achieved~~ a CGPA of at least 2.5 across all attempted courses.

Students must submit a program request on ACORN. Deadlines follow the Limited Enrolment Program Application Deadlines set by the [Office of the Registrar](#) each year. Failure to submit the program request on ACORN will result in the student's application not being considered.

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
 Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.
The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.
The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS,

MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

## MAJOR PROGRAM IN COMPUTER SCIENCE (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Major in Computer Science is limited.

Students may apply to enter the program after completing 4.0 credits, and must meet the requirements described below :

1. Students already admitted to the UTSC Year 1 Computer Science admissions category :

Required Courses :

Students must have passed ~~all~~ ~~of~~ the following ~~A-level~~ CSC and MAT courses : ~~required in the program~~ ~~(~~ CSCA08H3, CSCA48H3, [CSCA67H3 or MATA67H3], MATA22H3, MATA31H3, and MATA37H3 ~~)~~ .

Required Grades :

Students that meet all ~~are admitted on the basis~~ of ~~academic performance in program courses; for more information about~~ the following ~~admission~~ requirements will be admitted to a CS Major POSt :
a . A cumulative grade point average ( CGPA ) of at least 2.5 over the following courses : CSCA48H3, CSC / MATA67H3 , MATA22H3 , MATA31H3 , and MATA37H3;
b . A final grade of at least B in CSCA48H3; and
c . A final grade of at least C- in two of ~~please~~ ~~visit~~ the following : CSC / MATA67H3 , MATA22H3 , and MATA37H3 ~~CMS webpage~~ .

2 . Students admitted to other UTSC Year 1 admissions categories :

Students that have been ~~who~~ ~~are~~ ~~not~~ admitted to either the UTSC Year 1 Math or UTSC

Year 1 Statistics admissions categories ~~as above~~

~~,~~ ~~and~~ ~~who~~ are eligible to apply for ~~enrolled~~ ~~in~~ the ~~Minor~~ ~~in~~ Computer Science Major POSt . Admission will be based on academic performance in

~~,~~ ~~may apply after completing at least 7.5 credits~~ ~~,~~ ~~including~~ the required ~~core~~ A-level courses , identified ~~listed~~ above

. The admission requirements change each year depending on available spaces and the pool of eligible applicants

, and students are cautioned that there is no guarantee of admission; ~~as well~~ as such ~~CSC B07H3~~ * , students are strongly advised to plan to enroll in backup programs .

Students that have not been admitted to a UTSC Year 1 CMS admissions category ( Computer Science ~~CSCB09H3~~ * , Mathematics ~~CSCB36H3~~ * , or Statistics ) must achieve a final grade of ~~and~~ at least A- in both MATA31H3 and CSC / MATA67H3 the first time they complete these courses in order to be eligible to apply for a CS Major POSt ~~one of~~ ~~MATB24H3~~ ~~or~~ ~~STAB52H3~~ . This is a strict requirement . Admission will be based ~~Students are admitted~~ on ~~the basis of~~ academic performance in the required A-level courses , identified above

. The admission requirements change each year depending on available spaces and the pool of eligible applicants

, and students are cautioned that there is no guarantee of admission; as such , students are strongly advised to plan to enroll in backup programs .

For ~~program courses; for~~ more information about the admission requirements, please visit the following CMS webpage .

Note

: Students admitted to the program after second * ~~These courses have a CS subject P OSt~~ or third year will be required to pay retroactive deregulated program fees ~~minimum CG PA prerequisite~~ .

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**Description of Proposed Changes:**
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**Rationale:**
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since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.

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The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# MAJOR PROGRAM IN MATHEMATICS (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Major Program in Mathematics is limited.

Students may apply to enter the program after completing 4.0 credits, and must meet the requirements described below :

1. Students already admitted to the UTSC Year 1 Mathematics admissions category :

Required Courses :

Students must have passed all of the following A-level MAT and CSC and MAT courses : [ required in the program ( CSCA08H3 or CSCA20H3 ], [CSCA67H3 or / MATA67H3 ], MATA22H3, MATA31H3 , and MATA37H3 ) .

Required Grades :

Students that meet all of the following requirements will be ~~are~~ admitted to ~~on~~ the Mathematics Major POSt :
a . A cumulative grade point average ( CGPA ) of at least 2.0 over the following courses : CSC / MATA67H3 , MATA22H3 , MATA31H3 , and MATA37H3; and
b . A final grade of at least B in one of the following : CSC / MATA67H3 , MATA22H3 , and MATA37H3 .

2 . Students admitted to other UTSC Year 1 admissions categories :

Students that have been admitted to other CMS admissions categories ( Computer Science or Statistics ) or any other ~~basis~~ of the UTSC Year 1 admissions categories are eligible to apply for a Mathematics Major POSt . Admission will be based on academic performance in the required A-level courses , identified above . The admission requirements change each year depending on available spaces and the pool of eligible applicants , and students are cautioned that there is no guarantee of admission; as such , students are strongly advised to plan to enroll in backup programs .

For ~~program courses; for~~ more information about the admission requirements, please visit the following [CMS webpage](#) .

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
 Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.
The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.
The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion

of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# MAJOR PROGRAM IN STATISTICS (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Major Program in Statistics is limited.

Students may apply to enter the program after completing 4.0 credits, and must meet the requirements described below :
 1. Students already admitted to the UTSC Year 1 Statistics admissions category :

 Required Courses :

 Students must have passed all of the following A-level CSC and MAT courses : required for the program ( [CSCA08H3 or CSCA20H3], MATA22H3, [MATA30H3 or MATA31H3] and [MATA36H3 or MATA37H3] ) .

 Required Grades :

 Students that meet the following requirements will be are admitted to on the Statistics Major POSt :
 a . A cumulative grade point average ( CGPA ) basis of at least 2.3 over the following courses : CSCA08H3 / CSCA20H3 ,  MATA22H3 ,  MATA30 / 31H3 ,  and  MATA36 / 37H3 .

 2 . Students admitted to other UTSC Year 1 admissions categories :

 Students that have been admitted to other CMS admissions categories ( Computer Science or Mathematics ) or any other UTSC Year 1 admissions categories are eligible to apply for a Statistics Major POSt . Admission will be based on academic performance in the required A-level courses , identified above . The admission requirements change each year depending on available spaces and the pool of eligible applicants , and students are cautioned that there is no guarantee of admission; as such , students are strongly advised to plan to enroll in backup programs .

For ~~program~~ ~~courses;~~ ~~for~~ more information about the admission requirements, please visit the following [CMS webpage](#).

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.
The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.
The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**

There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# MINOR PROGRAM IN COMPUTER SCIENCE (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Minor in Computer Science is limited.

Students may apply to enter the program after completing 4.0 credits, and must have passed ~~all~~ ~~of~~ the following ~~A-level~~ CSC and MAT courses : ~~required in the program~~ [ CSCA08H3, CSCA48H3, and [ ( one of:CSCA67H3/MATA67H3, MATA22H3, MATA23H3, MATA30H3, MATA31H3, or MATA32H3 )
]. Admission will be based ~~Students are admitted~~ on ~~the basis of~~ academic performance in these A-level courses
. The admission requirements change each year depending on available spaces and the pool of eligible applicants
, and students are cautioned that there is no guarantee of admission; as such
, students are strongly advised to plan to enroll in backup programs .

For ~~program courses; for~~ more information about the admission requirements, please visit the following CMS webpage .

Students in the Minor may take a maximum of 3 CSC elective courses (1.5 credits) at the C-level and D-level.

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
 Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions

category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.

The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.

The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**

Current students will be grandfathered, and will not be impacted by the proposed changes.

New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**

There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**

Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# SPECIALIST (CO-OPERATIVE) PROGRAM IN COMPUTER SCIENCE (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Specialist (Co-operative) program in Computer Science (all streams) is limited.

*Current Co-op Students:*
Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits . Students ~~and~~ must have completed ~~passed~~ ~~all~~ ~~of~~ the required A-level CSC and MAT courses ~~required~~ ~~in~~ ~~the~~ ~~program~~ ~~(~~ ~~CSCA08H3~~ ~~,~~ ~~CSCA48H3~~ ~~,~~ ~~CSCA67H3~~ ~~,~~ ~~MATA22H3~~ ~~,~~ ~~MATA31H3~~ , and achieved ~~MATA37H3~~ ~~)~~ ~~.~~ ~~Students~~ ~~are~~ ~~admitted~~ ~~on~~ the required grades , described ~~basis~~ ~~of~~ ~~academic~~ ~~performance~~ in ~~program~~ ~~courses;~~ ~~for~~ ~~more~~ ~~information~~ ~~about~~ the Enrolment Requirements for ~~admission~~ ~~requirements~~ , ~~please~~ ~~visit~~ the Specialist in Computer Science ~~following~~ ~~CMS~~ ~~webpage~~ . In addition, they must also have achieved a CGPA of at least 2.5 across all attempted courses.

  * Students must select one stream of the CS Specialist Co-op . Admission to the

Entrepreneurship ~~stream~~ Stream also requires the submission of a Supplementary Application Form available ~~from the CMS website~~ .

~~Students who are not admitted as above , and who are enrolled in the Minor in Computer Science , may apply after completing at least 7.5 credits , including the core A-level courses listed above as well as CSCB07H3 , CSCB09H3 , CSCB36H3 and one of MATB24H3 or STAB52H3 . Students are admitted~~ on the Department ~~basis~~ of Computer and Mathematical Sciences ~~academic performance in program courses; for more information about the admission requirements , please visit the following CMS webpage . In addition , they must also have a CGPA of at least 2.5 across all attempted courses .~~

~~* These courses have a CS subject POSt or minimum CGPA prerequisite .~~

*Prospective Co-op Students:*
Prospective students (i.e., those not yet admitted to a Co-op Degree POSt) must meet the enrolment requirements noted above and have a CGPA of at least 2.75 across all attempted courses.

Students must submit a program request on ACORN. Deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each year. Failure to submit the program request on ACORN will result in the student's application not being considered.

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
 Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.
The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.
The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions

categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# SPECIALIST (CO-OPERATIVE) PROGRAM IN MATHEMATICS (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Specialist (Co-operative) Program in Mathematics is limited.

*Current Co-op Students:*
Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits . Students ~~and~~ must have completed ~~passed~~ ~~all~~ ~~of~~ the required A-level CSC and MAT courses ~~required~~ ~~in~~ ~~the~~ ~~program~~ ~~({ CSCA08H3~~ ~~or~~ ~~CSCA20H3 },~~ ~~CSCA67H3 / MATA67H3 ,~~ ~~MATA22H3~~ ~~, MATA31H3~~ , and achieved ~~MATA37H3 )~~ . ~~Students~~ ~~are~~ ~~admitted~~ ~~on~~ the required grades , described ~~basis~~ ~~of~~ ~~academic~~ ~~performance~~ in ~~program~~ ~~courses; for~~ ~~more~~ ~~information~~ ~~about~~ the Enrolment Requirements for ~~admission~~ ~~requirements~~ , ~~please~~ ~~visit~~ the Specialist in Mathematics ~~following~~ ~~CMS  webpage~~ . In addition, they must also have achieved a CGPA of at least 2.5 across all attempted courses.

*Prospective Co-op Students:*
Prospective students (i.e., those not yet ~~already~~ admitted to a Co-op Degree POSt) ~~may~~ ~~apply~~ ~~to~~ ~~the~~ ~~Co-op Program~~ ~~after~~ ~~completing~~ ~~4.0~~ ~~credits ,~~ ~~and~~ must meet ~~have~~ ~~passed~~ ~~all~~ ~~of~~ ~~the~~ ~~A-level~~ ~~CSC~~ ~~and~~ ~~MAT~~ ~~courses~~ ~~required~~ ~~in~~ ~~the~~ ~~program~~ ~~({ CSCA08H3~~ ~~or~~ ~~CSCA20H3 },~~ ~~CSCA67H3 / MATA67H3 ,~~ ~~MATA22H3 ,~~ ~~MATA31H3 ,~~ ~~and~~ ~~MATA37H3 )~~ ~~. Students~~ ~~are~~ ~~admitted~~ ~~on~~ ~~the~~ ~~basis~~ ~~of~~ ~~academic~~ ~~performance~~ ~~in~~ ~~program~~ ~~courses; for~~ ~~more~~ ~~information~~ ~~about~~ the enrolment ~~admission~~ requirements noted above and ~~, please~~ ~~visit~~ ~~the~~ ~~following~~ ~~CMS  webpage~~ ~~.~~ ~~In~~ ~~addition ,~~ ~~they~~ ~~must~~ ~~also~~ have ~~achieved~~ a CGPA of at least 2.5 across all attempted courses.

Students must submit a program request on ACORN. Deadlines follow the Limited Enrolment Program Application Deadlines set by the [Office of the Registrar](#) each year. Failure to submit the program request on ACORN will result in the student's application not being considered.

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
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a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
 Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.
The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.
The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process

were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# SPECIALIST PROGRAM IN COMPUTER SCIENCE (SCIENCE)

**Enrolment Requirements:**


**Enrolment Requirements**

Enrolment in the Specialist in Computer Science (all streams) is limited. Students may apply to enter the program after completing 4.0 credits, and must meet the requirements described below :

1. Students already admitted to the UTSC Year 1 Computer Science admissions category :

Required Courses :

Students must have passed ~~all of~~ the following ~~A-level~~ CSC and MAT courses : ~~required in the program (~~ CSCA08H3, CSCA48H3, [CSCA67H3 or MATA67H3], MATA22H3, MATA31H3, and MATA37H3 ~~)~~ .

Required Grades :

Students that meet all of the following requirements will be ~~are~~ admitted to a CS Specialist POSt * :
 a . A cumulative grade point average ( CGPA ) of at least 2.5 over ~~on~~ the following courses : CSCA48H3 , CSC / MATA67H3 , MATA22H3 , MATA31H3 , and MATA37H3;
 b . A final grade ~~basis~~ of at least B ~~academic performance~~ in CSCA48H3; and
 c . A final grade of at least C- in two of ~~program courses; for more information about~~ the following : CSC / MATA67H3 ~~admission requirements~~ , MATA22H3 , and MATA37H3 .

 * Students must select one stream of ~~please visit~~ the CS Specialist as follows :
 a
. Students can select either the Comprehensive stream or the Software Engineering stream ~~following CMS webpage~~ .
 b . A limited number of students will be admitted to the Information Systems stream , depending on available space .
 c . Admission to the Entrepreneurship stream will be based in part on ~~also requires the~~ submission of a Supplementary Application Form (SAF) available on the Department of Computer and Mathematical Sciences   [website](#) .

 2 . Students ~~who are not~~ admitted to other UTSC Year 1 admissions categories :

Students that have been admitted to either the UTSC Year 1 Math or UTSC Year 1 Statistics admissions categories are eligible to apply for the Computer Science Specialist POSt
. Admission will be based on academic performance in the required A-level courses , identified ~~as~~ above
. The admission requirements change each year depending on available spaces and the pool of eligible applicants, and students ~~who~~ are cautioned that there is no guarantee of admission; as such
, students are strongly advised to plan to enroll ~~enrolled in the Minor~~ in backup programs .

Students that have not been admitted to a UTSC Year 1 CMS admissions category (Computer Science, Mathematics , or Statistics ) must achieve a final grade of ~~may apply after completing~~ at least A- in both MATA31H3 and CSC / MATA67H3 ~~7.5 credits~~
~~, including~~ the first time they complete these courses  in order to be eligible to apply for a CS Specialist POSt
. This is a strict requirement . Admission will be based on academic performance in the required ~~core~~ A-level courses ~~listed above as well as CSCB07H3 , CSCB09H3~~

, identified above ~~CSCB36H3 and one of MATB24H3 or STAB52H3~~
. The admission requirements change each year depending ~~Students are admitted~~ on available spaces and the pool ~~basis~~ of eligible applicants , and students are cautioned that there is no guarantee of admission; as such , students are strongly advised to plan to enroll ~~academic performance~~ in backup programs .

For ~~program courses; for~~ more information about the admission requirements, please visit the following [CMS webpage](#) ~~.~~

~~* These courses have a CS subject POSt or minimum CGPA prerequisite~~ .

To remain in the program, a student must maintain a CGPA of 2.0 or higher throughout  the  program .

Note
:  Students  admitted  to  the  program  after  second  or  third  year  will  be  required  to  pay  retroactive  deregulated program  fees.

**Completion Requirements:**

**Program Requirements**
The program requirements comprise a core of 18 courses (9.0 credits), common to all streams and additional requirements which depend on the stream, for a total of 27 courses (13.5 credits) for the Comprehensive, Software Engineering, and Entrepreneurship streams, and 29 courses (14.5 credits) for the Information Systems stream.

**Note:** Many Computer Science courses are offered both at U of T Scarborough and at the St. George campus. When a course is offered at both campuses in a given session, U of T Scarborough students are expected to take that course at U of T Scarborough. The Department of Computer Science at the St. George campus cannot guarantee space for U of T Scarborough students in their courses, especially those offered at both campuses.

**Core (9.0 credits)**

**1. Writing Requirement (0.5 credit)***
 *0.5 credit from the following:* ANTA01H3, ANTA02H3, (CLAA02H3), (CTLA19H3), CTLA01H3, ENGA10H3, ENGA11H3, ENGB06H3, ENGB07H3, ENGB08H3, ENGB09H3, ENGB17H3, ENGB19H3, ENGB50H3, (ENGB51H3), GGRA02H3, GGRA03H3, GGRB05H3, (GGRB06H3), (HISA01H3), (HLTA01H3), ACMA01H3, (HUMA01H3), (HUMA11H3), (HUMA17H3), (LGGA99H3), LINA01H3, PHLA10H3, PHLA11H3, WSTA01H3.
 ***Note:** It is recommended that this requirement be satisfied by the end of the second year.

**2. A-level courses (3.0 credits)**
 CSCA08H3 Introduction to Computer Science I
 CSCA48H3 Introduction to Computer Science II
 CSCA67H3 Discrete Mathematics
 MATA22H3 Linear Algebra I for Mathematical Sciences
 MATA31H3 Calculus I for Mathematical Sciences
 MATA37H3 Calculus II for Mathematical Sciences

**3. B-level courses (3.5 credits)**
 CSCB07H3 Software Design
 CSCB09H3 Software Tools and Systems Programming
 CSCB36H3 Introduction to the Theory of Computation
 CSCB58H3 Computer Organization
 CSCB63H3 Design and Analysis of Data Structures
 MATB24H3 Linear Algebra II
 STAB52H3 Introduction to Probability

**4. C-level courses (1.5 credits)**
 CSCC43H3 Introduction to Databases

CSCC69H3 Operating Systems
CSCC73H3 Algorithm Design and Analysis

**5. D-level courses (0.5 credit)**
CSCD03H3 Social Impact of Information Technology

**A. Comprehensive Stream**
This stream requires a total of 27 courses (13.5 credits). In addition to the core requirements 1-5 common to all streams, 9 other distinct courses (4.5 credits) must be chosen to satisfy all of the following requirements:

*6. Additional required courses (2.5 credits)*
CSCC24H3 Principles of Programming Languages
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics
CSCC63H3 Computability and Computational Complexity
CSCD37H3 Analysis of Numerical Algorithms for Computational Mathematics
MATB41H3 Techniques of the Calculus of Several Variables I

*7. Electives from courses on computer systems and applications (1.0 credit)*
Choose from:
CSCC01H3 Introduction to Software Engineering
CSCC09H3 Programming on the Web
CSCC10H3 Human-Computer Interaction
CSCC11H3 Introduction to Machine Learning and Data Mining
CSCC46H3 Social and Information Networks
CSCC85H3 Fundamentals of Robotics and Automated ~~Introduction to Embedded~~ Systems
CSCD01H3 Engineering Large Software Systems
CSCD18H3 Computer Graphics
CSCD27H3 Computer and Network Security
CSCD43H3 Database System Technology
CSCD58H3 Computer Networks
CSCD70H3 Compiler Optimization
CSCD84H3 Artificial Intelligence
CSC320H Visual Computing
CSC321H Introduction to Neural Networks and Machine Learning
CSC401H Natural Language Computing
CSC469H Operating Systems Design and Implementation
CSC485H Computational Linguistics
CSC488H Compilers and Interpreters

*8. Electives from courses related to the theory of computing (0.5 credit)*
Choose from:
MATC09H3 Introduction to Mathematical Logic
MATC32H3 Graph Theory and Algorithms for its Applications
MATC44H3 Introduction to Combinatorics
MATD16H3 Coding Theory and Cryptography
CSC438H Computability and Logic
CSC448H Formal Languages and Automata
CSC465H Formal Methods in Software Design

*9. CSC, MAT, or STA elective (0.5 credit)*
Any C- or D-level CSC, MAT, or STA course, excluding MATC82H3, MATC90H3, STAC32H3, STAC53H3 and STAD29H3.

**B. Software Engineering Stream**
This stream requires a total of 27 courses (13.5 credits). In addition to the core requirements 1-5 common to all streams, 9 other distinct courses (4.5 credits) must be chosen to satisfy all of the following requirements:

*6. Additional required courses (3.0 credits)*
CSCC01H3 Introduction to Software Engineering
CSCC24H3 Principles of Programming Languages
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics
CSCC63H3 Computability and Computational Complexity
CSCD01H3 Engineering Large Software Systems
MATB41H3 Techniques of the Calculus of Several Variables I

*7. Electives from courses on computer systems and applications (1.5 credits)*
Choose from:
CSCC09H3 Programming on the Web
CSCC10H3 Human-Computer Interaction
CSCC11H3 Introduction to Machine Learning and Data Mining
CSCC46H3 Social and Information Networks
CSCC85H3 Fundamentals of Robotics and Automated ~~Introduction to Embedded~~ Systems
CSCD18H3 Computer Graphics
CSCD27H3 Computer and Network Security
CSCD43H3 Database System Technology
CSCD58H3 Computer Networks
CSCD70H3 Compiler Optimization
CSCD84H3 Artificial Intelligence
CSC320H Visual Computing
CSC321H Introduction to Neural Networks and Machine Learning
CSC401H Natural Language Computing
CSC469H Operating Systems Design and Implementation
CSC485H Computational Linguistics
CSC488H Compilers and Interpreters


## C. Information Systems Stream
This stream requires a total of 29 courses (14.5 credits). In addition to the core requirements 1-5 common to all streams, 11 other distinct courses (5.5 credits) must be chosen to satisfy all of the following requirements:

*6. Required management courses (1.5 credits)*
MGTA01H3 Introduction to Business
MGTA02H3 Managing the Business Organization
MGHB02H3 Managing People and Groups in Organizations

*7. Additional required mathematics and computer science courses (3.0 credits)*
CSCC01H3 Introduction to Software Engineering
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics
CSCC63H3 Computability and Computational Complexity
CSCD01H3 Engineering Large Software Systems
CSCD43H3 Database System Technology
MATB41H3 Techniques of the Calculus of Several Variables I

*8. Electives from courses on computer systems and applications (1.0 credit)*
Choose from:
CSCC09H3 Programming on the Web
CSCC10H3 Human-Computer Interaction
CSCC11H3 Introduction to Machine Learning and Data Mining
CSCC46H3 Social and Information Networks
CSCC85H3 Fundamentals of Robotics and Automated ~~Introduction to Embedded~~ Systems
CSCD18H3 Computer Graphics
CSCD27H3 Computer and Network Security
CSCD58H3 Computer Networks
CSCD70H3 Compiler Optimization

CSCD84H3 Artificial Intelligence
CSC320H Visual Computing
CSC321H Introduction to Neural Networks and Machine Learning
CSC401H Natural Language Computing
CSC469H Operating Systems Design and Implementation
CSC485H Computational Linguistics
CSC488H Compilers and Interpreters


**D. Entrepreneurship Stream**
This stream requires a total of 27 courses (13.5 credits). In addition to the core requirements 1-5 common to all streams, 9 other distinct courses (4.5 credits) must be chosen to satisfy all of the following requirements:

*6. Additional required courses (3.0 credits)*
CSCC01H3 Introduction to Software Engineering
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics
CSCC63H3 Computability and Computational Complexity
CSCD01H3 Engineering Large Software Systems
CSCD54H3 Technology Innovation and Entrepreneurship
CSCD90H3 The Startup Sandbox

*7. Electives from courses in computer science, mathematics, and statistics (1.5 credits)*
Choose from:
CSCC09H3 Programming on the Web
CSCC10H3 Human-Computer Interaction
CSCC11H3 Introduction to Machine Learning and Data Mining
CSCC24H3 Principles of Programming Languages
CSCC46H3 Social and Information Networks
CSCC85H3 Fundamentals of Robotics and Automated ~~Introduction to Embedded~~ Systems
CSCD18H3 Computer Graphics
CSCD27H3 Computer and Network Security
CSCD43H3 Database System Technology
CSCD58H3 Computer Networks
CSCD70H3 Compiler Optimization
CSCD84H3 Artificial Intelligence
MATB41H3 Techniques of the Calculus of Several Variables I
STAB57H3 Introduction to Statistics
CSC320H Visual Computing
CSC321H Introduction to Neural Networks and Machine Learning
CSC401H Natural Language Computing
CSC469H Operating Systems Design and Implementation
CSC485H Computational Linguistics
CSC488H Compilers and Interpreters

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in

Statistics, Quantitative Finance Stream.
3. The course title for CSCC85H3 has been changed.

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.
The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.
The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.
A course change proposal was submitted for CSCC85H3 and the program requirements have been updated to reflect this.

**Impact:**
Current students will be grandfathered, and will not be impacted by the proposed changes.
New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# SPECIALIST PROGRAM IN MATHEMATICS (SCIENCE)

**Enrolment Requirements:**

**Enrolment Requirements**

Enrolment in the Specialist Program in Mathematics (all streams) is limited.

Students may apply to enter the program after completing 4.0 credits, and must meet the requirements described below :

1. Students already admitted to the UTSC Year 1 Mathematics admissions category :

Required Courses :

Students must have passed ~~all~~ ~~of~~ the following ~~A-level~~ ~~MAT~~ ~~and~~ CSC and MAT courses : ~~required in the program~~ ( [CSCA08H3 or CSCA20H3], [CSCA67H3 or ~~/~~ MATA67H3 ], MATA22H3, MATA31H3, and MATA37H3 ~~)~~ .

Required Grades :

Students that meet all of the following requirements will be ~~are~~ admitted to a Mathematics Specialist POSt * of their choice :
a . A cumulative grade point average ( CGPA ) of at least 2.5 over ~~on~~ the following courses : CSC / MATA67H , MATA22H3 , MATA31H3 , and MATA37H3; and
b . A final grade of at least B in two of the following : CSC / MATA67H3 , MATA22H3 , and MATA37H3 .

* Students must select one stream of the Mathematics Specialist .

2 . Students admitted to other UTSC Year 1 admissions categories :

Students that have been admitted to other CMS admissions categories ( Computer Science or Statistics ) or any other ~~basis~~ of the UTSC Year 1 admissions categories are eligible to apply for a Mathematics Specialist POSt . Admission will be based on academic performance in the required A-level courses , identified above . The admission requirements change each year depending on available spaces and the pool of eligible applicants , and students are cautioned that there is no guarantee of admission; as such , students are strongly advised to plan to enroll in backup programs .

For ~~program courses; for~~ more information about the admission requirements, please visit the following [CMS webpage](#) .

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**Completion Requirements:**

**Program Requirements**
The Program requirements consist of a core 15 courses (7.5 credits), common to all streams, and additional requirements that depend on the stream, for a total of 26-27 courses (13.0-13.5 credits).

The structure of the programs allows for easy switching between streams until relatively late. Consequently, these programs should not be viewed as rigidly separated channels feeding students to different career paths, but as a flexible structure that provides guidance to students in their course selection based on their broad (but possibly fluid) interests.

**Core (7.5 credits)**

**1. Writing Requirement (0.5 credit) (*)**
*0.5 credits from the following:* ANTA01H3, ANTA02H3, (CLAA02H3), (CTLA19H3), CTLA01H3, ENGA10H3, ENGA11H3, ENGB06H3, ENGB07H3, ENGB08H3, ENGB09H3, ENGB17H3, ENGB19H3, ENGB50H3, (ENGB51H3),

GGRA02H3, GGRA03H3, GGRB05H3, (GGRB06H3), (HISA01H3), (HLTA01H3), ACMA01H3, (HUMA01H3), (HUMA11H3), (HUMA17H3), (LGGA99H3), LINA01H3, PHLA10H3, WSTA01H3.
(*) It is recommended that this requirement be satisfied by the end of the second year.

## 2. A-level courses (2.5 credits)
[CSCA08H3 Introduction to Computer Science I or CSCA20H3 Introduction to Programming]
MATA22H3 Linear Algebra I for Mathematical Sciences
MATA31H3 Calculus I for Mathematical Sciences
MATA37H3 Calculus II for Mathematical Sciences
[MATA67H3 or CSCA67H3 Discrete Mathematics]

## 3. B-level courses (3.5 credits)
MATB24H3 Linear Algebra II
MATB41H3 Techniques of the Calculus of Several Variables I
MATB42H3 Techniques of the Calculus of Several Variables II
MATB43H3 Introduction to Analysis
MATB44H3 Differential Equations I
STAB52H3 Introduction to Probability (* *)
STAB57H3 Introduction to Statistics (* *)
(* *) This course may be taken after the second year, except for the Statistics stream.

## 4. C-level courses (1.0 credit)
MATC01H3 Groups and Symmetry
MATC34H3 Complex Variables


## A. Comprehensive Stream
This stream requires a total of 27 courses (13.5 credits) In addition to the core requirements 1-4 common to all streams, 12 other distinct courses must be chosen satisfying all of the following requirements:

### 5. *Additional courses in analysis and algebra (1.5 credits):*
1.5 credits from the following:
MATC37H3 Introduction to Real Analysis
MATC46H3 Differential Equations II
MATD01H3 Fields and Groups
MATD35H3 Introduction to Discrete Dynamical Systems
MATD46H3 Partial Differential Equations

### 6. *Courses in key areas of mathematics (1.0 credit):*
1.0 credit from the following:
MATC15H3 Introduction to Number Theory
MATC27H3 Introduction to Topology
MATC63H3 Differential Geometry
MATD02H3 Classical Plane Geometries and their Transformations
MATD34H3 Complex Variables II

### 7. *Mathematics of computation (1.0 credit):*
1.0 credit from the following:
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics
CSCC63H3 Computability and Computational Complexity
CSCC73H3 Algorithm Design and Analysis
MATC09H3 Introduction to Mathematical Logic
MATC32H3 Graph Theory and Algorithms for its Applications
MATC44H3 Introduction to Combinatorics
MATD16H3 Coding Theory and Cryptography
MATD44H3 Topics in Combinatorics

### 8. *Electives (2.5 credits):*

2.5 credits from CSC/MAT/STA/PHY of which at least 1.5 must be at the C- or D-level MAT courses ( excluding MATC90H3 ) .

**B. Statistics Stream**
This stream requires a total of 26 courses (13.0 credits). In addition to the core requirements 1-4 common to all streams, 11 other distinct courses must be chosen, satisfying all of the following requirements (in choosing courses to satisfy requirements 7-9, students must select at least one D-level course).

*5. Algebra and Analysis (1.5 credits):*
MATB61H3 Linear Programming and Optimization
MATC46H3 Differential Equations II
MATD01H3 Fields and Groups

*6. Statistics (1.5 credits):*
STAC58H3 Statistical Inference
STAC62H3 Probability and Stochastic Processes I
STAC67H3 Regression Analysis

*7. Discrete mathematics and geometry (0.5 credit):*
0.5 credit from the following:
MATC32H3 Graph Theory and Algorithms for its Applications
MATC44H3 Introduction to Combinatorics
MATD02H3 Classical Plane Geometries and their Transformations
MATD44H3 Topics in Combinatorics
MATD50H3 Mathematical Introduction to Game Theory

*8. Upper-level MAT electives (1.0 credit):*
1.0 credit from any C- or D-level MAT courses (*)
(*) For students wishing to pursue graduate studies in Mathematics or Statistics it is recommended that MATC37H3 be chosen as one of these two courses.

*9. Upper-level STA electives (1.0 credit):*
1.0 credit from the following:
(ACTB47H3) Introductory Life Contingencies
Any C- or D-level STA course, excluding STAC32H3, STAC53H3 and STAD29H3

**C. Teaching Stream**
This stream requires a total of 26 courses (13.0 credits). In addition to the core requirements 1-4 common to all streams, 11 other distinct courses must be chosen, satisfying all of the following requirements:

*5. Algebra, analysis, and geometry (1.5 credits):*
1.5 credits from the following:
MATC15H3 Introduction to Number Theory
MATD01H3 Fields and Groups
MATD02H3 Classical Plane Geometries and their Transformations
MATD35H3 Introduction to Discrete Dynamical Systems
MATD46H3 Partial Differential Equations

*6. Discrete mathematics (0.5 credit):*
0.5 credit from the following:
MATC32H3 Graph Theory and Algorithms for its Applications
MATC44H3 Introduction to Combinatorics
MATD44H3 Topics in Combinatorics

*7. MAT electives (1.5 credits):*
1.5 credits of any C- or D-level MAT courses

*8. MAT/STA/CSC electives (2.0 credits):*
2.0 credits of any C- or D-level MAT, STA, CSC courses, excluding STAC32H3, STAC53H3 and STAD29H3
It is recommended that students obtain a TA-ship within the Department of Computer and Mathematical Sciences.

**Description of Proposed Changes:**
1. The Admissions process for students coming from high school has been changed. Rather than admitting students to a general CMS admissions category, students are admitted into a specific Computer Science (CS), Mathematics (MAT), or Statistics (STA) admissions category. To be admitted into these admission categories, they must have met the following minimum requirements:
a. 6 grade 12U or M courses including ENG4U, MHF4U, MCV4U (or equivalent).
2. To be admitted to a CS, MAT, or STA program, students admitted to the CS, MAT, and STA admissions categories must:
a. Complete specified A-level Computer Science and Mathematics courses;
b. Achieve the identified minimum grades;
c. Satisfy other requirements as described.
 Note: the changes to the enrolment requirements for the Specialist in Statistics do not impact the Double Degree: BBA, Specialist/Specialist Co-op Program in Management and Finance/Honours BSC, Specialist/Specialist Co-op Program in Statistics, Quantitative Finance Stream.
3. Comprehensive stream, component 8 of the program requirements: remove provision excluding MATC90H3
4. Statistics stream, component 6: revise course title for STAC62H3

**Rationale:**
The Department of Computer and Mathematical Science (CMS) has been reviewing and revising the admissions criteria for their Computer Science (CS), Mathematics (MAT), and Statistics (STA) programs every year for the past several years. Some changes have been small - for example, gradually increasing CGPA requirements each year; and some have been more substantial - for example, establishing methods for students to qualify for a program based on B-level grades. More recently, CMS has been engaged in a thorough re-evaluation of the entire admissions process. The impetus for this re-evaluation has been three-fold: first, and most importantly, to address the needs of students by significantly reducing, if not entirely eliminating, uncertainty and stress regarding admissions criteria; second, to ensure that the admissions criteria support the Department's academic goals; and finally, to ensure the admissions criteria are in line with the resources available within the Department.
Under the current admissions process, new UTSC students are admitted from high school into a general CMS admissions category. After completing the first 4.0 credits, students are able to apply to specific programs, and those who achieve the minimum criteria established each year are guaranteed admission. This process creates uncertainty and stress for students since the minimum criteria are always changing, and many CMS students are not admitted to the CMS program that they intended to study. It is also problematic for the Department since it inevitably leads to programs and courses that are oversubscribed.
The revised admissions process mirrors the process adopted by the Department of Computer Science in the Faculty of Arts and Science on the St. George campus. Effective Fall 2021, UTSC students will be admitted from high school into a specific CS, MAT, or STA admissions category, and these students will be admitted to the corresponding program, as long as they complete the required A-level CSC and MAT courses, and achieve the required minimum grades in selected courses. These new criteria focus on establishing an aptitude to succeed in the program, rather than creating a detrimental competitive environment for students.
The Department anticipates that the vast majority of students who are admitted to the CS, MAT, and STA admissions categories prior to their first year of studies will be able to achieve the minimum grades needed to be admitted to a program associated with the admission category upon completion of their first 4.0 credits. Students who are not admitted to the CS, MAT, or STA admission categories will also have the chance to apply for CS, MAT, or STA programs after the completion of first year courses; admission through this route will be competitive and, admittedly, will be more difficult to achieve. It is anticipated that this new process will greatly mitigate the stress students experience since it will eliminate much of the uncertainty around whether they will be accepted into a CS, MAT, or STA program. Every student who enters CMS as a first-year student will feel confident that they will be admitted to the program corresponding to their admission category as long as they achieve the very reasonable grade requirements. It will also ensure that CMS accepts only as many students as it has the resources to properly support.
 MATC90H3 should be allowed as an elective for students in the Specialist programs in Mathematics.
Course title for STAC62H3 has been revised.

**Impact:**

Current students will be grandfathered, and will not be impacted by the proposed changes.

New students will follow the new admissions process, and must meet the new enrolment requirements. It is anticipated that these changes will be beneficial to new students since they will reduce uncertainty and consequently mitigate the stress that students typically experience when applying to programs.

**Consultation:**
There has been extensive discussion within CMS, and review of the admissions process in place in cognate programs at the sister campuses of the University. There has been consultation with the Office of the Registrar, Arts and Science Co-op Office, and the Office of the Vice-Principal Academic and Dean at UTSC. The proposed changes to the admissions process were also discussed with the review team s part of the 2019-20 external review; the review team was supportive of the changes.

Minor modifications to the program requirements approved by the DCC on Oct. 13, 2020.

**Resource Implications:**
Under the current enrolment requirements, maintaining an appropriate balance of students and resources has been challenging. It is anticipated that the proposed changes will help to ensure the number of students in CMS programs does not exceed the resources available to teach them.

# 1 New Course:

## CSCD25H3: Advanced Data Analysis

**Contact Hours:**

**Description:**
This course teaches the basic techniques, methodologies, and ways of thinking underlying the application of data science and machine learning to real-world problems. Students will go through the entire process going from raw data to meaningful conclusions, including data wrangling and cleaning, data analysis and interpretation, data visualization, and the proper reporting of results. Special emphasis will be placed on ethical questions and implications in the use of AI and data. Topics include data pre-processing, web scraping, applying supervised and unsupervised machine learning methods, treating text as data, A/B testing and experimentation, and data visualization.

**Prerequisites:**
CSCB63H3 and CSCC11H3 and [a CGPA of 3.5 or enrolment in a CSC Subject POSt]

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**

**Enrolment Limits:**
40

**Note:**

**Learning Outcomes:**
● Understand the techniques and software tools required to perform the fundamental steps of the data analysis pipeline
● Perform data acquisition (data formats, data joining, Web scraping, data APIs, open data, big data platforms, etc.)
● Perform data wrangling/cleaning (de-duplifying, correcting incomplete and incorrect data, data reconciliation, etc.)
● Perform data analysis (apply proper statistical and machine learning methods, comparison to reasonable baselines, etc.)
● Perform data interpretation (statistics, exploratory visualizations, deriving qualitative insights from quantitative results, etc.)
● Perform result communication (reporting, data visualization, publishing reproducible results, addressing ethical concerns, etc.)

**Topics Covered:**
Applying Supervised ML
Regression

Classification
Bias-variance tradeoff
k-NN
Applying Unsupervised ML
Clustering
PCA / SVD / Embeddings
Data wrangling / Data cleaning / Web scraping
Text as Data
Document classification
Sentiment analysis
Topic detection
tf-IDF
A/B testing / Experimentation
Regression analysis
Evaluation / Model selection
Network analysis
Data Visualization
Ethics of working with data

**Methods of Assessment:**
Assignments — practice applying specific components of the data analysis pipeline to datasets and problems
Exam — test knowledge of concepts in a more controlled setting
Course Project — apply data analysis pipeline from end to end to a specific problem on a real-world dataset

**Mode of Delivery:**
In Class

**Breadth Requirements:**
Quantitative Reasoning

**Rationale:**
The recent boom in the field of computer science is largely attributable to the availability of large-scale datasets, cheap computational resources, and easily applicable machine learning methods. Indeed, "Data scientist" was LinkedIn's #1 "most promising job" in 2019, and is one of the most popular job titles on the platform. However, UTSC currently does not have a class that teaches students the skills necessary to do data science in the real world and apply machine learning methods to data. This course will fill that void by teaching students about the entire pipeline going from raw data to meaningful conclusions—crucial "data literacy" skills that will serve them well no matter whether they go into industry, government, or academia. The course will cover data wrangling and cleaning, data analysis and interpretation (applying supervised and unsupervised machine learning methods), treating text as data (e.g. topic models, word embedding methods, etc.), A/B testing and experimentation (how to run a proper experiment, basic experimental design, how to avoid traps that many fall into), data visualization and communication (how to effectively and honestly communicate your results), and more. A central concern of the course will be focused on the ethical implications of working with data and AI (not a separate, siloed component but a thread woven throughout the entire course).
The course has been given an enrolment limit because it includes a project component, as well as assignments that will require large computational resources and significant TA/instructor time. The enrolment limit is to ensure students have a good learning experience.

**Consultation:**
Approved by the DCC on Oct. 1, 2020.
New course code approved by Tammy Parsonson in the R/O on Oct. 14, 2020.

**Resources:**
The course will be taught by regular faculty and will require TA support which will be covered by the unit's existing budget. It will not require additional equipment or laboratory fees.

**2021-22 Curriculum Cycle**
**Undergraduate Minor Curriculum Modifications for Approval**
**Report: Physical and Environmental Sciences**
March 26, 2021

## Physical & Environmental Sciences (UTSC), Department of

# 4 New Courses:

### EESC38H3: The Anthropocene

| | |
|---|---|
| **Contact Hours:** | |
| **Description:**<br>"The Anthropocene" is a term that now frames wide-ranging scientific and cultural debates and research, surrounding how humans have fundamentally altered Earth's biotic and abiotic environment. This course explores the scientific basis of the Anthropocene, with a focus on how anthropogenic alterations to Earth's atmosphere, biosphere, cryosphere, lithosphere, and hydrosphere, have shifted Earth into a novel geological epoch. Students in this course will also discuss and debate how accepting the Anthropocene hypothesis, entails a fundamental shift in how humans view and manage the natural world. Same as ESTC38H3. | |
| **Prerequisites:**<br>ESTB01H3 and [1.0 credit from the following: EESB03H3, EESB04H3 and EESB05H3] | |
| **Corequisites:** | |
| **Exclusions:**<br>ESTC38H3 | |
| **Recommended Preparation:** | |
| **Enrolment Limits:** | |
| **Note:** | |
| **Learning Outcomes:**<br>Students will be able to:<br>1. Formulate generalizable and testable scientific hypotheses.<br>2. Understand the analytical methods used in environmental research.<br>3. Synthesize scientific data and execute statistical analyses in order to test scientific hypotheses.<br>4. Critically assess the strengths and limitations of research in the natural sciences.<br>5. Demonstrate critical thinking skills with respect to scientific research.<br>6. Demonstrate strong written and oral science communication skills. | |
| **Topics Covered:**<br>a) The scientific origins and basis of the Anthropocene hypothesis.<br>b) Where the Anthropocene Epoch fits in the context of Earth's geological history.<br>c) How changes in Earth's atmosphere, biosphere, cryosphere, hydrosphere, and lithosphere i) underpin the differentiation | |

of time periods through Earth's geological history, and in turn ii) are used to define the existence and onset of the Anthropocene Epoch.

d) The extent, causes, consequences, and pace of anthropogenic changes to Earth's environmental cycles, patterns, and processes (i.e., those noted in point c above).

e) How the "Anthropocene Epoch"—which began as a geology-based hypothesis—now frames discussions and debates on how humans interact with the natural world, in multiple academic disciplines.

From a technical skills perspective, the course covers the following themes:

a) Generating and testing scientific research questions.

b) Statistical analyses, including descriptive statistics, linear regression, analysis of variance, and time series analyses.

c) Replication and repeatability, as a key scientific concept.

d) The peer-review process for evaluating scientific research.

**Methods of Assessment:**

Assessments for will include:

1. A final written report that includes data analyses (using open access data sources), valuating a new line of evidence to support the existence of the Anthropocene (related to Learning Outcomes 1-3 and 6 above).

2. In-class seminar leadership and participation, wherein students present a paper focused on a certain dimension of the Anthropocene (related to Learning Outcome 4 and 5 above).

3. In-class student debates, wherein students argue for or against which lines of scientific evidence should be considered key markers of the Anthropocene (related to Learning Outcomes 1 and 4-6 above).

**Mode of Delivery:**

In Class

**Breadth Requirements:**

Natural Sciences

**Rationale:**

In the early 2000s, scientists began constructing arguments that the current period of Earth's ~4.6 billion year history, is primarily defined by the dominance of humans on environmental patterns and processes: a period now widely acknowledged as the "Anthropocene Epoch". The scientific basis of the Anthropocene hypothesis includes research demonstrating the uniqueness and magnitude of anthropogenic changes to Earth's climate, hydrology, geology, biodiversity, and species biogeography. The growing importance of the Anthropocene as a core environmental science concept is well demonstrated by the proliferation of scientific articles and journals on the topic, as well as increasing investments in Anthropocene-based research at UTSC and elsewhere (e.g., UTSC's recently-approved Centre for Environmental Research in the Anthropocene (CERA)). Based on this scientific landscape, training environmental science students in the core concepts of the Anthropocene is critical for students understanding: i) the basis of the rapidly growing literature on the Anthropocene, and ii) how and why the Anthropocene factors into many emerging and novel fields of environmental research. The proposed course will:

1. Contribute the first C-level environmental science course that explicitly focuses on the extent, cause, and consequences of global environmental change; thereby filling a curriculum gap that currently exists in the Specialist in Environmental Biology program.

2. Consolidate and expand, in a single course, the scientific theory and evidence that supports the Anthropocene hypothesis; thereby providing the first course that explicitly teaches the physical science basis for one of the most important and novel scientific concepts of our time.

3. Provide a course where environmental science students learn the social and political aspects of the Anthropocene hypothesis; thereby providing the first required courses in DPES' environmental science curricula, where science students engage with social dimensions of global change science.

4. Emphasize in DPES' environmental science programs, the importance of understanding how scientific hypotheses are generated and tested; thereby providing a course where hypothesis generation and testing is a core theme.

**Consultation:**

1.DPES' Supervisors of Study for the Specialist Environmental Geoscience program (M. Meriano).

2. DPES' Discipline Representative for Environmental Studies (N. Klenk).

3. The Associate Chair Undergraduate within DPES (namely, Lana Mikhaylichenko) and DPES' Teaching and Curriculum Committee on October 7th, 2020.

4. The proposal was distributed among EES group at the beginning of October 2020 for the feedback.

5. Course code approved by UTSC Registrar's Office on October 7th, 2020.

**Resources:**

1. EESC38H3 will be taught as part of the regular teaching load for A. Martin, the recently appointed Assistant Professor of Global Environmental Change, in DPES.
2. EESC38H3 will require additional TA support, at an estimated rate of one 35-hour appointment, which is covered by the unit's existing budget.
3. EESC38H3 does not require any additional infrastructure and/ or equipment.
4. EESC38H3 will not require ancillary and/ or laboratory fees.

# EESD31H3: Applied Climatology

**Contact Hours:**

**Description:**
This course will introduce and discuss the basic topics and tools of applied climatology, and how its concepts can be used in everyday planning and operations (e.g. in transportation, agriculture, resource management, health and energy). The course involves the study of the application of climatic processes and the reciprocal interaction between climate and human activities. Students will also learn the methods of analyzing and interpreting meteorological and climatological data in a variety of applied contexts. Topics include: Solar Energy; Synoptic Climatology and Meteorology; Climate and Agriculture; Climate and Energy; Climate and Human Comfort; Urban Effects on Climate and Air Pollution.
Jointly offered with EES1131H

**Prerequisites:**
STAB22H3 and EESB03H3 and [an additional 1.0 credit in EES courses, of which 0.5 credit must be at the C-level]

**Corequisites:**

**Exclusions:**
EES1131H

**Recommended Preparation:**

**Enrolment Limits:**
38

**Note:**

**Learning Outcomes:**
By the end of the course, students:
1.      Will be able to define the fields of applied climatology and will have an appreciation of the diversity of the fields in which applied climatological work is done.
2.      Will be able to understand and assess the effects of weather and climate and their impacts on the climate sensitive industries.
3.      Will be able to synthesize scientific data for use in applied climatology fields.
4.      Will be able to evaluate the assumption of climate stationarity and assess the evidence for/against inadvertent climate modification considering the nonstationary time series data.
5.      Will be able to apply the principles of the applied climatological science as they relate to human activities and various environmental sectors to solve sector-based climate change issues.
6.      Will be able to present applied climatological science through oral and written works.

**Topics Covered:**
-       Principles of Applied climatological fields
-       Statistical Considerations in applied climatology (stationarity vs nonstationary)
-       Climate and Physical/Biological Environment interaction-part I
-       Climate and Physical/Biological Environment interaction-part II
-       Climate and the applied sectors of Environment –part I
-       Climate and the applied sectors of Environment –part II
-       Climate and the applied sectors of Environment –part III
-       Urban climate and global environmental change
-       Climate Extremes and Natural Hazards

**Methods of Assessment:**
The course grade will be made up class participation (10%), assignments (35%), Midterm (25%) and a final project (30%).
 The tutorials in the courses will be held in a computer lab and the students are expected to participate in exercises and

discussions. Scientific data and specific software will be used to analyze data from the applied climatological fields.
There will be three assignments that will include three different applied sectors (covered during lectures) such as infrastructure and climate, agricultural climatology, and urban modification and/or applied climatology sectors.
A midterm test will be held in the course to assess the problem-solving approaches through the use of the analytical and critical thinking skills that the students developed from various applied climatological perspectives.
Final Project: students will work independently on a final project by choosing an applied sector and using the applied climatological knowledge and the software learned during the tutorials. The evaluation of the final project includes the presentation of the project to a team of expert judges invited from the academics and the industries on the final day of class.

**Mode of Delivery:**
In Class

**Breadth Requirements:**
Natural Sciences

**Rationale:**
There are currently no courses focused on applied climatology available for students who are interested in learning more about how the knowledge of applied climatological science is used in environmental science, specifically climate science. The proposed course fills this gap. The course will be of interest to students in Environmental Science, Physics and Chemistry programs.

**Consultation:**
Approved by the Teaching and Curriculum Committee at the Department of Physical and Environmental Sciences on November 13, 2020.
The course code was approved by the Registrar's Office on: November 6, 2020.

**Resources:**
The course will be taught by existing faculty as part of their regular teaching load. Depending on enrollment, additional TA hours may be required and will be covered by DPES's existing budgets.

# ESTC38H3: The Anthropocene

**Contact Hours:**

**Description:**
"The Anthropocene" is a term that now frames wide-ranging scientific and cultural debates and research, surrounding how humans have fundamentally altered Earth's biotic and abiotic environment. This course explores the scientific basis of the Anthropocene, with a focus on how anthropogenic alterations to Earth's atmosphere, biosphere, cryosphere, lithosphere, and hydrosphere, have shifted Earth into a novel geological epoch. Students in this course will also discuss and debate how accepting the Anthropocene hypothesis, entails a fundamental shift in how humans view and manage the natural world.
Same as EESC38H3

**Prerequisites:**
ESTB01H3 and [1.0 credit from the following: EESB03H3, EESB04H3 and EESB05H3]

**Corequisites:**

**Exclusions:**
EESC38H3

**Recommended Preparation:**

**Enrolment Limits:**

**Note:**

**Learning Outcomes:**
Students will be able to:
1. Formulate generalizable and testable scientific hypotheses.
2. Understand the analytical methods used in environmental research.
3. Synthesize scientific data and execute statistical analyses in order to test scientific hypotheses.
4. Critically assess the strengths and limitations of research in the natural sciences.

5. Demonstrate critical thinking skills with respect to scientific research.
6. Demonstrate strong written and oral science communication skills.

**Topics Covered:**
a) The scientific origins and basis of the Anthropocene hypothesis.
b) Where the Anthropocene Epoch fits in the context of Earth's geological history.
c) How changes in Earth's atmosphere, biosphere, cryosphere, hydrosphere, and lithosphere i) underpin the differentiation of time periods through Earth's geological history, and in turn ii) are used to define the existence and onset of the Anthropocene Epoch.
d) The extent, causes, consequences, and pace of anthropogenic changes to Earth's environmental cycles, patterns, and processes (i.e., those noted in point c above).
e) How the "Anthropocene Epoch"—which began as a geology-based hypothesis—now frames discussions and debates on how humans interact with the natural world, in multiple academic disciplines.
 From a technical skills perspective, the course covers the following themes:
a) Generating and testing scientific research questions.
b) Statistical analyses, including descriptive statistics, linear regression, analysis of variance, and time series analyses.
c) Replication and repeatability, as a key scientific concept.
d) The peer-review process for evaluating scientific research.

**Methods of Assessment:**
Assessments for will include:
1. A final written report that includes data analyses (using open access data sources), valuating a new line of evidence to support the existence of the Anthropocene (related to Learning Outcomes 1-3 and 6 above).
2. In-class seminar leadership and participation, wherein students present a paper focused on a certain dimension of the Anthropocene (related to Learning Outcome 4 and 5 above).
3. In-class student debates, wherein students argue for or against which lines of scientific evidence should be considered key markers of the Anthropocene (related to Learning Outcomes 1 and 4-6 above).

**Mode of Delivery:**
In Class

**Breadth Requirements:**
Natural Sciences

**Rationale:**
In the early 2000s, scientists began constructing arguments that the current period of Earth's ~4.6 billion year history, is primarily defined by the dominance of humans on environmental patterns and processes: a period now widely acknowledged as the "Anthropocene Epoch". The scientific basis of the Anthropocene hypothesis includes research demonstrating the uniqueness and magnitude of anthropogenic changes to Earth's climate, hydrology, geology, biodiversity, and species biogeography. The growing importance of the Anthropocene as a core environmental science concept is well demonstrated by the proliferation of scientific articles and journals on the topic, as well as increasing investments in Anthropocene-based research at UTSC and elsewhere (e.g., UTSC's recently-approved Centre for Environmental Research in the Anthropocene (CERA)). Based on this scientific landscape, training environmental science students in the core concepts of the Anthropocene is critical for students understanding: i) the basis of the rapidly growing literature on the Anthropocene, and ii) how and why the Anthropocene factors into many emerging and novel fields of environmental research. The proposed course will:
1. Contribute the first C-level environmental science course that explicitly focuses on the extent, cause, and consequences of global environmental change; thereby filling a curriculum gap that currently exists in the Specialist in Environmental Biology program.
2. Consolidate and expand, in a single course, the scientific theory and evidence that supports the Anthropocene hypothesis; thereby providing the first course that explicitly teaches the physical science basis for one of the most important and novel scientific concepts of our time.
3. Provide a course where environmental science students learn the social and political aspects of the Anthropocene hypothesis; thereby providing the first required courses in DPES' environmental science curricula, where science students engage with social dimensions of global change science.
4. Emphasize in DPES' environmental science programs, the importance of understanding how scientific hypotheses are generated and tested; thereby providing a course where hypothesis generation and testing is a core theme.

**Consultation:**
1. DPES' Supervisors of Study for the Specialist Environmental Geoscience program (M. Meriano).
2. DPES' Discipline Representative for Environmental Studies (N. Klenk).

3. The Associate Chair Undergraduate within DPES (namely, Lana Mikhaylichenko) and DPES' Teaching and Curriculum Committee on October 7th, 2020.
4. The proposal was distributed among EES group at the beginning of October 2020 for the feedback.
5. Course code approved by UTSC Registrar's Office on October 7th, 2020.

**Resources:**
1. ESTC38H3 will be taught as part of the regular teaching load for A. Martin, the recently appointed Assistant Professor of Global Environmental Change, in DPES.
2. ESTC38H3 will require additional TA support, at an estimated rate of one 35-hour appointment, which is covered by the unit's existing budget.
3. ESTC38H3 does not require any additional infrastructure and/ or equipment.
4. ESTC38H3 will not require ancillary and/ or laboratory fees.

# PHYC14H3: Introduction to Atmospheric Physics

**Contact Hours:**

**Description:**
This course provides an introduction to atmospheric physics. Topics include atmospheric structure, atmospheric thermodynamics, convection, general circulation of the atmosphere, radiation transfer within atmospheres and global energy balance. Connections will be made to topics such as climate change and air pollution.

**Prerequisites:**
PHYB21H3 and PHYB52H3 and MATB42H3 and MATB44H3

**Corequisites:**

**Exclusions:**
PHY392H1, PHY315H1, PHY351H5

**Recommended Preparation:**

**Enrolment Limits:**

**Note:**

**Learning Outcomes:**
After completing this course, students will be able to:
- Describe the physical reasons for the structure of the atmosphere.
- Use the basic concepts of atmospheric thermodynamics, e.g., describe conditions of stability and convection, calculate adiabatic and non-adiabatic lapse rates, understand significance of potential temperature for the stability of the atmosphere.
- Use Schwarzschild's equation and Beer's Law to calculate radiative transfer through an atmosphere.
- Explain the basic physics of scattering, absorption, and emission of radiation.
- Understand basic spectroscopic principles, e.g., Doppler and pressure-dependent broadening of absorption features, and apply them to atmospheric measurement techniques, e.g., remote sensing; examine spectral measurements and identify major features.
- Use energy balance models to calculate and explain the greenhouse effect and global energy budget, e.g., two-layer atmosphere and continuously stratified atmosphere in radiative equilibrium.
- Know the forces on a parcel of air on a rotating planet and explain the general patterns of global atmospheric circulation.
- Explain why pressure is a useful vertical coordinate for atmospheric physics.
- Explain the major anthropogenic and natural factors driving climate variability.

**Topics Covered:**
- Atmospheric structure
- Atmospheric thermodynamics
- Radiation transfer within atmospheres
- General circulation of the atmosphere
- Global energy balance

**Methods of Assessment:**
As a physics course, there will be an emphasis on developing quantitative problem solving skills in the atmospheric topics covered, assessment will include problem sets, term tests, and final exam.
There will be an assignment involving an analysis of the physics of atmospheric monitoring instruments.

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| **Mode of Delivery:** |
| In Class |

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| **Breadth Requirements:** |
| Natural Sciences |

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| **Rationale:** |
| The proposed course fills a gap in the current Physics course offerings at UTSC. A course in atmospheric physics aligns with the existing emphasis of the physics and astrophysics group on planetary science and connects the physics course offerings to the wider DPES topics – e.g., environmental science – and topics of significant societal interest, such as climate change and atmospheric composition change. It is being added as a prerequisite for PHYD27H3, and will support the Environmental Physics program, which is the most popular DPES Physics & Astrophysics specialist program. In addition, it will support senior research projects (i.e., PHYD01 & PHYD72) in the area of atmospheric physics. |
| There are similar courses offered at UTSG and UTM, and they have been identified as exclusions, but there are no similar physics courses are offered at UTSC. Thus, the proposed course does not make any existing UTSC courses redundant. |
| The course will be distinctive not only in the topic it covers, but also in that it can take advantage of real-world atmospheric data being collected at UTSC at the new atmospheric observatory. This will provide an innovative tangible aspect to the course. |

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| **Consultation:** |
| July 21, 2020: consultation with Prof. Julian Lowman (program supervisor for Environmental Physics). |
| July 27, 2020: consultation with the physics and astrophysics group through email as well as Prof. Karen Smith (who has relevant expertise in subject matter). |
| August 17, 2020: consultation with the physics and astrophysics group through email to circulate revised proposal. |
| October 7th: approved by Departmental Teaching and Curriculum Committee. |
| October 8, 2020: course code approved by RO |

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| **Resources:** |
| The course will be taught by existing faculty as part of their regular teaching load. TA support may be required, depending on enrolments, and will be covered by the academic unit's existing budgets. The course does not require additional space or infrastructure. |

# 2 Course Modifications:

## EESD09H3: Research Project in Environmental Science

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| **Description:** |
| This course entails the ~~The~~ design, implementation, and reporting of an independent and ~~a~~ substantial research project, under the direct supervision of a faculty member. Research may involve ~~involving~~ laboratory, fieldwork, and/or computer-based analyses, with the final products being presented primarily as ~~fieldwork. Existing faculty research allows~~ a written thesis, although other course work, such as oral presentations ~~broad range~~ of student research, may also be required. All areas of environmental science research that are supported by existing faculty members are permissible ~~possible topics~~. The course should be undertaken after the end of the 3rd Year, and is subject to faculty availability. Faculty permission and supervision is required ~~required; open only to those students who have either completed or are undertaking specialist courses in the area of intended study. Students having a B+ or higher standing may be eligible for summer financial support from research projects~~. |

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| **Prerequisites:** |
| **Previous**: At least 1.0 credit at the C-level in EES courses and 0.5 credit at the C-level in CHM, or PHY courses. |
| **New**: Permission of the course coordinator. |

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| **Exclusions:** |
| **Previous**: GLG470Y, GLG471H |
| **New**: EESD10Y3 |

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| **Recommended Preparation:** |

| PSCB90H3 and EESC24H3 |
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**Note:**
**Previous**:
**New**: Students must apply to the course coordinator for admission into this course. Applications must be received by: (i) the end of August for enrolment in the fall semester; (ii) the end of December for enrolment in the spring semester; or (iii) the end of April for enrolment in the summer semester. Applications should consist of a completed 1-page application form (available from the course instructor) that includes: 1. Student name, number, academic program, and current year of study; 2. A note of intent indicating the student's wish to enrol in EESD09H3; 3. A brief description of the projects of interest to the student; 4. A list of relevant courses successfully completed by the student, as well as any relevant courses to be taken during the concurrent session; 5. The confirmed name of the supervising professor, the date and method in which confirmation of their willingness to supervise was received (i.e., this must determined ahead of time, through personal correspondence with a professor). Generally, only students meeting the following requirements will be admitted to EESD09H3: 1. A Cumulative Grade Point Average of 2.5 or higher; 2. Completion of at least 12.0 full credits (see point 4 below) ; 3. Completion of at least 1.5 full credits of C-level environmental science courses (see point 4 below) ; 4. For students in the Specialist/Specialist Co-op programs Environmental Physics, completion of Year 3 and completion of at least 1.0 C-level PHY courses. Students who do not meet these criteria are strongly encouraged to consider enrolment in PSCB90H3 and/ or EESC24H3 as an alternative to EESD09H3. Once the course coordinator (or designate) has approved enrolment to EESD09H3, they will sign the course enrolment form for submission to the registrar. Note that the course coordinator (or designate) is the only one permitted to give "permission of instructor" on this form.

**Rationale:**
1. The course prerequisites have changed to "Permission of course coordinator." In its current iteration, certain prerequisites—most notably requirements for 0.5 C-level credits from chemistry (CHM) or physics (PHY)—are not applicable/ necessary for the diverse range of research that exists in the Department of Physical and Environmental Sciences' Environmental Science Group. Moreover, the C-level CHM and PHY course requirement acts as an obstacle to talented students in the Specialist/Specialist Co-op programs in Environmental Biology.
2. The course exclusions have been revised to include "EESD10Y3", the full-credit environmental science research course. This update is informed by course exclusions employed in the research courses in other DPES disciplines (namely, Chemistry). This exclusion update also removes GLG470Y and GLG471H, which are no longer offered.

**Consultation:**
This proposal has proceeded through the following consultation:
 1. Supervisor's of Study within DPES' Environmental Science Discipline Group (M. Meriano, J. Lowman, A. Martin); completed Sept. 21st, 2020.
 2. Researchers within DPES' Environmental Science Discipline Group, who are conducting research that is relevant to this course (M. Isaac, C. Mitchell); completed Sept. 21st, 2020.
 3. The Associate Chair Undergraduate within DPES (L. Mikhaylichenko) and DPES' Teaching and Curriculum Committee; completed Oct. 7th, 2020.

**Resources:**
None

# EESD10Y3: Research Project in Environmental Science

**Description:**
This course entails the ~~The~~ design, implementation, and reporting of an independent and ~~a~~ substantial research project , under the direct supervision of a faculty member . Research may involve ~~involving~~ laboratory, fieldwork , and/or computer-based analyses, with the final products being presented primarily as ~~fieldwork~~ . ~~Existing faculty research allows~~ a written thesis, though other course work , such as oral presentations ~~broad range~~ of student research , may also be required . All areas of environmental science research that are supported by existing faculty members are permissible ~~possible topics~~ . The course should be undertaken after the end of the 3rd Year, and is subject to faculty availability. Faculty permission and supervision is required ~~required; open only to those students who have either completed or are undertaking specialist courses in the area of intended study~~ . ~~Students having a B+ or higher standing may be eligible for summer financial support from research projects~~ . ~~Permission of the co-ordinator must be obtained~~ .

**Prerequisites:**
**Previous**: At least 1.0 credit at the C-level in EES courses and 0.5 credit at the C-level in CHM, or PHY courses.
**New**: Permission of the course coordinator.

**Exclusions:**
**Previous**: GLG470Y, GLG471H
**New**: EESD09H3

**Recommended Preparation:**
PSCB90H3 and EESC24H3

**Note:**
**Previous**:
**New**: Students must apply to the course coordinator for admission into this course. Applications must be received by the end of August for enrolment in the fall semester. Applications should consist of a completed 1-page application form (available from the course instructor) that includes: 1. Student name, number, academic program, and current year of study; 2. A note of intent indicating the student's wish to enrol in EESD10Y3; 3. A brief description of the projects of interest to the student; 4. A list of relevant courses successfully completed by the student, as well as any relevant courses to be taken during the concurrent session; 5. The confirmed name of the supervising professor, the date and method in which confirmation of their willingness to supervise was received (i.e., this must determined ahead of time, through personal correspondence with a professor). Generally, only students meeting the following requirements will be admitted to EESD10Y3: 1. A Cumulative Grade Point Average of 2.5 or higher; 2. Completion of at least 12.0 full credits (see point 4 below) ; 3. Completion of at least 1.5 full credits of C-level environmental science courses (see point 4 below) ; 4. For students in the Specialist/Specialist Co-op programs in Environmental Physics, completion of Year 3 and completion of at least 1.0 C-level PHY courses. Students who do not meet these criteria, are strongly encouraged to consider enrolment in PSCB90H3 and/ or EESC24H3 as an alternative to EESD10Y3. Once the course coordinator (or designate) has approved enrolment to EESD10Y3, they will sign the course enrolment form for submission to the registrar. Note that the course coordinator (or designate) is the only one permitted to give "permission of instructor" on this form.

**Rationale:**
1. The course prerequisites have been changed to "Permission of course coordinator." In its current iteration, certain prerequisites—most notably requirements for 0.5 C-level credits in chemistry (CHM) or physics (PHY)—are not applicable/ necessary for the diverse range of research that exists in the Department of Physical and Environmental Sciences' Environmental Science Group. Moreover, this C-level CHM and PHY course requirement acts as an obstacle for talented students in the Specialist/Specialist Co-op programs in Environmental Biology.
2. The course exclusions have been revised to include "EESD10Y3", the full-credit environmental science research course. This update is informed by course exclusions employed in the research courses in other DPES disciplines (namely, Chemistry). This exclusion has also been updated to remove GLG470Y and GLG471H, which are no longer offered.
3. The recommended preparation has been updated to include PSCB90H3, which is appropriate preparation for EESD10Y3.

**Consultation:**
1. Supervisor's of Study within DPES' Environmental Science Discipline Group (M. Meriano, J. Lowman, A. Martin); completed Sept. 21st, 2020.
 2. Researchers within DPES' Environmental Science Discipline Group, who are conducting research that is relevant to this course (M. Isaac, C. Mitchell); completed Sept. 21st, 2020.
3. The Associate Chair Undergraduate within DPES (L. Mikhaylichenko) and DPES' Teaching and Curriculum Committee; completed Oct. 7th, 2020.

**Resources:**
None.