MATHEMATICAL SCIENCES - BACHELOR OF SCIENCE

Overview

Mathematics is the study of numbers, shapes, and relationships. Computer Science is the study of algorithms. Statistics is the science of collecting and analyzing data. Put them all together, and you get mathematical sciences.

To major in mathematical sciences means you choose two of the following disciplines: Computer Science, Mathematics, Statistics, and successfully complete the required number of courses. You may also choose to minor in any of the other disciplines offered in the Bachelor of Science program.

Contact Information

Department of Mathematics and Statistics
Room 5-107, City Centre Campus
10700 - 104 Avenue
Edmonton, AB T5J 4S2
T: 780-497-5786

Arts and Science Academic Advising
Room 6-211, City Centre Campus
T: 780-497-4505
E: artsandscience@macewan.ca

Bachelor of Science

Faculty of Arts and Science
MacEwan.ca/Science (http://MacEwan.ca/Science/)

The Bachelor of Science (BSc) is a foundational general degree that provides broad and widely applicable knowledge and abilities rather than a niche specialization. This broad base equips graduates with generalist knowledge and skills that give the flexibility and agility so highly valued in a dynamic world economy. It also offers students a solid foundation to specialize in future employment or further schooling.

The degree provides a breadth of study across various Arts and Science disciplines and sets the foundation for later years. The major and minor areas of study allow students to focus and gain in-depth expertise in complementary or entirely disparate disciplines; there is a wide array of possible combinations. Finally, options enable students to explore courses outside their disciplines or even within their program, enhancing their diversity of learning. The small classes, close interaction between instructors and students, opportunities for individual study, and faculty with a strong focus on teaching are signature strengths of this program.

General Program Information

The BSc requires students to complete 120 credits of non-duplicative coursework. The BSc emphasizes breadth and depth and has been designed for exceptional flexibility and customization. Students can complete a major and a minor, a double major, or a major and two minors. Students can choose a secondary major in an Arts or Science discipline, but the primary major must be in a Science discipline.

All newly admitted students enter the BSc program as “Undeclared.” Undeclared means a student has not yet chosen their major(s) and minor(s). Students may declare at any time after being accepted to the BSc, and typically, they declare after completing a minimum of 45 credits. The Arts and Science Academic Advising Office will send information about majors and minors via email and newsletters; please contact the Advising Office if you require further assistance with this decision.

Science Disciplines

Discipline	Major	Minor	Honours
Applied Statistics	◉	-	◉
Biological Sciences	◉	◉	◉
Chemistry	◉	◉	-
Computer Science	◉	◉	-
Earth and Planetary Sciences	-	◉	-
Environmental Sciences	-	◉	-
Mathematics	◉	◉	◉
Mathematical Sciences	◉	-	-
Planetary Physics	-	◉	-
Physical Sciences	◉	-	-
Physics	-	◉	-
Psychology	◉	◉	◉
Statistics	-	◉	-

Arts Disciplines

Discipline	Major	Minor
Anthropology	◉	◉
Classics		◉
Creative Writing		◉
Economics	◉	◉
English	◉	◉
Film Minor for Arts and Science		◉
French		◉
Gender Studies		◉
History	◉	◉
Philosophy	◉	◉
Political Science	◉	◉
Sociology	◉	◉
Spanish		◉

Out of Faculty Minors

Discipline	Minor
Accounting Minor for Arts and Science	◉
Arts and Cultural Management	◉
Business Law	◉
Business Studies	◉

Digital Experience Design	◉
Finance Minor for Arts and Science	◉
Human Resources Minor for Arts and Science	◉
Marketing Minor for Arts and Science	◉

Laddering a Diploma into the Bachelor of Science

Students with an accredited diploma can ladder into the Bachelor of Science (BSc) and use some of their diploma coursework towards their degree requirements. If you have questions about the diploma laddering process, please visit www.macewan.ca/bscstudent or contact artsandscience@macewan.ca.

Preparing for Professional Studies

Students intending to enter professional programs at other universities can take their pre-professional programs in the Faculty of Arts and Science at MacEwan University. The university offers the first and second years of several pre-professional programs, including chiropractic medicine, dental hygiene, dentistry, medical laboratory science, medicine, optometry, pharmacy, and veterinary medicine. All courses in these pre-professional programs are credit courses, and, as such, they may apply to the degrees offered by MacEwan University.

Students are advised to consult the admissions requirements for the universities and programs of their choice and to select their MacEwan University courses accordingly. Completing pre-professional courses at MacEwan University does not guarantee admission to the subsequent professional program. Each professional program requires a separate application, and entry is competitive, not automatic.

Degree Requirements

Breadth Requirements

All Bachelor of Science degrees require Breadth Requirements. Courses can satisfy both the breadth requirements and requirements for the major(s), minor(s), Honours, or options. BIOL, CHEM, EASC, or PHYS courses must include a laboratory component.

Breadth Element	Description	Credits
Biological or Earth and Planetary Sciences	BIOL or EASC (not including BIOL 101, BIOL 102, or BIOL 103)	6
Chemistry or Physics	CHEM or PHYS	6
English	ENGL 102 and 3 credits in university English (not including ENGL 111, ENGL 108, or ENGL 211)	6
Humanities	CLAS, COMP, HIST, HUMN, PHIL or a language other than English	6
Mathematical Sciences	One of MATH 114, MATH 120, or MATH 125, and 3 credits in MATH, STAT, or CMPT (not including MATH 160, MATH 170, or CMPT 104)	6
Social Sciences	ANTH, ECON, GEND, LING, POLS, PSYC, or SOCI	6

Bachelor of Science Degree

Program Element	Description	Credits
Primary Major	The Science major will range from 42 to 60 credits with a minimum 36 credits taken at the senior-level.[1]	42-60
Secondary Major or Minor(s)	Students have the option of completing a second Science or Arts major, or one or two minors. Minor courses must be completed at the senior-level.[1]	18-60
Options	Students can complete up to 18 credits in out-of-faculty options, with no more than 3 credits in physical activity (PACT) courses	Up to 60
	Total Degree Credits Including Breadth	120

1

Multi-disciplinary majors consist of 60-72 junior- and senior-level credits. Students majoring in mathematical or physical sciences may pursue a minor but are not required to do so.

Bachelor of Science Honours

Program Element	Description	Credits
Minimum Honours Requirements	Honours requirements are determined by each discipline.	63
Option Courses, Non-Compulsory Honours Courses, and/or a Minor	Students have the option of completing a minor from outside of the Honours discipline. Some disciplines may require a minor.	57
	Total Degree Credits Including Breadth	120

The minimum passing grade for a course at MacEwan University is a D unless otherwise noted next to the appropriate course in the program of study. In the Faculty of Arts and Science, students typically require a minimum grade of C- to use a course as a prerequisite. Please check course descriptions for more information.

Cross-Faculty Course Recognitions

Cross-Faculty course recognition represents an agreement between programs within MacEwan University and consists of a number of approved courses that have the potential to be recognized within another degree. These courses are not considered transfers or equivalents as the original course will show within a student's transcript and their Academic Planning and Progress Report (APPR). How the courses listed below might be used within a student's degree are determined by the

student's program of study. They are dependent on a number of factors including year of declaration, year of completion, and individual program requirements.

Out-of-Faculty Course	Course Recognition	Course Used For
ACUP 117	ARTOP 1XX	Options; fulfills Humanities Breadth
ACUP 209	SCIOP 2XX	Options
ACUP 220, ACUP 303, and ACUP 304 (must complete all three courses)	COSL 200 (6 credits)	Options
ACUP 320	SCIOP 3XX	Options
AGAD 300	COSL 300	Options
AGAD 435	WINL 300	Options
ARTE 104	ARTOP 1XX	Options; fulfills Humanities Breadth
ARTE 214	ARTOP 2XX	Options; fulfills Humanities Breadth
ARTE 224	ARTOP 2XX	Options; fulfills Humanities Breadth
ARTE 234	ARTOP 2XX	Options; fulfills Humanities Breadth
ARTE 304	ARTOP 3XX	Options; fulfills Humanities Breadth
ARTE 314	ARTOP 3XX	Options; fulfills Humanities Breadth
ARTE 324	ARTOP 3XX	Options; fulfills Humanities Breadth
CORR 102	SOCI 1XX	Options or Sociology program requirements; fulfills Social Science Breadth
CORR 104	SOCI 1XX	Options or Sociology program requirements; fulfills Social Science Breadth
CORR 110	SOCI 225	Options or Sociology program requirements; fulfills Social Science Breadth
CORR 120	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
CORR 202	ARTOP 2XX	Options
CORR 208	ARTOP 2XX	Options
CORR 214	COSL 200	Options
CORR 218	SOCI 321	Options or Sociology program requirements; fulfills Social Science Breadth
CORR 224	COSL 200	Options
CYCW 100	PSYC 2XX	Options or Psychology program requirements; fulfills Social Science Breadth
CYCW 108 and CYCW 112	SOCI 1XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 115	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 114	ARTOP 1XX	Options
CYCW 201	PSYC 2XX	Options or Psychology program requirements; fulfills Social Science Breadth
CYCW 204	COSL 200	Options
CYCW 205	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 206	ARTOP 2XX	Options
CYCW 208	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 211	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 302	ARTOP 3XX	Options; fulfills Social Science Breadth
CYCW 303	ARTOP 3XX	Options; fulfills Social Science Breadth
CYCW 339	ARTOP 3XX	Options; fulfills Social Science Breadth
CYCW 340	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 350	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 360	SOCI 3XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 361	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
CYCW 466	ARTOP 4XX	Options
DESN 270	ARTOP 2XX	Options; fulfills Humanities Breadth
DESN 271	ARTOP 2XX	Options; fulfills Humanities Breadth
ECCS 110	PSYC 1XX	Options or Psychology program requirements; fulfills Social Science Breadth

ECCS 115	ARTOP 1XX	Options
ECCS 160	PSYC 2XX	Options or Psychology program requirements; fulfills Social Science Breadth
ECCS 180	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science breadth
ECCS 220	COSL 200	Options
ECCS 255	ARTOP 2XX	Options
ECCS 260	SOCI 2XX	Options or Psychology program requirements; fulfills Social Science Breadth
ECCS 270	COSL 200	Options
ECCS 310	SOCI 3XX	Options or Sociology program requirements; fulfills Social Science Breadth
ECCS 355	SOCI 3XX	Options or Sociology program requirements; fulfills Social Science Breadth
ECCS 360	SOCI 3XX	Options or Sociology program requirements; fulfills Social Science Breadth
ECCS 425	SOCI 4XX	Options or Sociology program requirements; fulfills Social Science Breadth
ECDV 160	ARTOP 1XX	Options
ECDV 220	COSL 200	Options
ECDV 255	ARTOP 2XX	Options
ECDV 260	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
ECDV 270	COSL 270	Options
ECDV 280	PSYC 2XX	Options or Psychology program requirements; fulfills Social Science Breadth
FNCE 301	ECON 3XX	Options or Economics program requirements; fulfills Social Science Breath
HAPR 101	SCIOP 1XX	Options
HAPR 104	ARTOP 1XX	Options
HAPR 114	WINL 200	Options
HAPR 201	ARTOP 2XX	Options
HAPR 212	WINL 200	Options
HEED 110	ARTOP 1XX	Options
HEED 120	SCIOP 1XX	Options
HLSC 104	SCIOP 1XX	Options
HLSC 105	SCIOP 1XX	Options
HLSC 120	BIOL 1XX	Options or Biological Sciences program requirements
HLSC 124	BIOL 1XX	Options or Biological Sciences program requirements
HLSC 126	BIOL 1XX	Options or Biological Sciences program requirements
HLSC 128	BIOL 2XX	Options or Biological Sciences program requirements
HLST 150	SCIOP 1XX	Options
HLST 210	ARTOP 2XX	Options
HLST 290	SCIOP 1XX	Options
INFM 101	ARTOP 1XX	Options
INFM 202	ARTOP 2XX	Options
INFM 208	ARTOP 2XX	Options
INFM 209	ARTOP 2XX	Options
INFM 210	ARTOP 2XX	Options
INFM 260	COSL 200	Options
INTA 210	ARTOP 2XX	Options; fulfills Humanities Breadth
INTA 362	ARTOP 3XX	Options
MTST 120	BIOL 1XX	Options or Biological Sciences program requirements
MTST 122	BIOL 1XX	Options or Biological Sciences program requirements
MTST 125	BIOL 1XX	Options or Biological Sciences program requirements
MTST 126	BIOL 1XX	Options or Biological Sciences program requirements
MTST 161, MTST 162, MTST 260, MTST 261, MTST 262	COSL 200	Options
MUSC 104	ARTOP 1XX	Options
MUSC 123	ARTOP 1XX	Options; fulfills Social Science Breadth
MUSC 124	ARTOP 1XX	Options; fulfills Social Science Breadth
PEDS 100	BIOL 1XX	Options or Biological Sciences program requirements
PEDS 101	BIOL 1XX	Options or Biological Sciences program requirements
PEDS 103	BIOL 2XX	Options or Biological Sciences program requirements
PEDS 109	SCIOP 1XX	Options
PEDS 200	BIOL 2XX	Options or Biological Sciences program requirements

PEDS 203	SCIOP 2XX	Options
PEDS 206	BIOL 2XX	Options or Biological Sciences program requirements
PEDS 207	BIOL 2XX	Options or Biological Sciences program requirements
PEDS 209	ARTOP 2XX	Options
PEDS 240	SCIOP 1XX	Options
PERL 104	ARTOP 1XX	Options
PERL 204	ARTOP 2XX	Options
PERL 207	ARTOP 2XX	Options
PSSC 102	ARTOP 1XX	Options
PSSC 112	ARTOP 1XX	Options
PSSC 121	SOCI 1XX	Options or Sociology program requirements; fulfills Social Science Breadth
PSSC 203	ARTOP 2XX	Options
PSSC 204	ARTOP 2XX	Options
PSSC 212	ARTOP 2XX	Options
PSSC 252	ARTOP 2XX	Options
PSSC 253	ARTOP 2XX	Options
PSSC 272	COSL 200	Options
PSSC 273	COSL 200	Options
SOWK 101	ARTOP 1XX	Options; fulfills Humanities Breadth
SOWK 111	ARTOP 1XX	Options
SOWK 112	ARTOP 1XX	Options
SOWK 203	ARTOP 2XX	Options
SOWK 204	SOCI 2XX	Options or Sociology program requirements; fulfills Social Science Breadth
TAST 101	ARTOP 1XX	Options
TAST 129 and TAST 130	COSL 200	Options
THAR 240	ARTOP 2XX	Options
THAS 101	ARTOP 1XX	Options
THAS 102	SCIOP 1XX	Options
THAS 115	ARTOP 1XX	Options
THAS 203	COSL 200	Options
THAS 210	COSL 200	Options
THAS 211	COSL 200	Options
THAS 214	COSL 200	Options
THAS 222	ARTOP 2XX	Options
THPR 205	ARTOP 2XX	Options; fulfills Humanities Breadth
THPR 206	ARTOP 2XX	Options; fulfills Humanities Breadth
THPR 214	COSL 200	Options
THPR 224	COSL 200	Options

Mathematical Sciences Requirements

Mathematical Sciences Major

The Bachelor of Science (BSc) in Mathematical Sciences program requires students to complete 120 credits of non-duplicative coursework. The major is comprised of three disciplines – computer science, mathematics, and statistics. Students select two of the three as their primary disciplines. While students in this major are not required to complete a minor, if any of computer science, mathematics or statistics disciplines are chosen as a minor, all senior-level credits in that discipline will only count toward the minor.

Students are required to complete option courses as well as the Mathematical Sciences Major and the possible minor. All BSc degrees require Breadth Requirements. Courses can satisfy both the breadth requirements and requirements for the major(s), minor(s), or options.

The Mathematical Sciences Major is 60 to 72 credits with a minimum of 42 senior-level credits. Students must complete:

- a minimum of three credits at the 300- or 400-level in each of their primary disciplines,
- a minimum of 12 credits at the 300- or 400-level across their primary disciplines, and
- at least 3 credits in a 400-level class in one of their primary disciplines.

If mathematics is a primary discipline – STAT 265, STAT 266, STAT 312, and STAT 412 may be used to fulfill this requirement.

Bachelor of Science - Mathematical Sciences Major

Code	Title	Credits
Specific Major Requirements		
MATH 114	Elementary Calculus I	3
MATH 115	Elementary Calculus II	3
MATH 120	Basic Linear Algebra I	3
or MATH 125	Linear Algebra I	
CMPT 101	Introduction to Computing I	3
or CMPT 103	Introduction to Computing II	
General Major Requirements		
Primary Discipline I		
Choose 18 to 24 junior- or senior-level credits from the first primary discipline		18-24
Primary Discipline II		
Choose 18 to 24 junior- or senior-level credits from the second primary discipline		18-24
General Requirements		
Choose 6 to 12 credits of junior- or senior- level CMPT, MATH, or STAT		6-12
Minor		
Students have the option of completing a minor. Minor courses must be completed at the senior level.		0-18
Options		
Students can complete up to 18 credits in out-of-faculty options, with no more than 3 credits in physical activity (PACT) courses.		30-60
Total Credits		**120**

Degree Regulations

Students are strongly encouraged to seek advice from the faculty advisors about program planning.

Academic Residency - Credit Requirements

In addition to the academic residency requirements of the University, upon admission to the Bachelor of Science (BSc), students must complete at MacEwan University:

- A minimum of 24 credits at the senior-level in the major discipline, with 12 of those senior credits completed at the 300- or 400-level. All 400-level requirements are to be completed at MacEwan University.
- If applicable, a minimum of nine credits in a minor at the senior-level, with at least three of those credits completed at the 300- or 400-level.

Students with a previous MacEwan University credential are required to complete a minimum of 45 credits upon admission to the BSc.

Students who hold a baccalaureate degree from another post-secondary institution must complete a minimum of 60 additional MacEwan University credits applicable to the BSc. Forty-five of these credits must be completed while the students is enrolled in the BSc. This credit requirement applies to students who began their studies at MacEwan University and completed a credential at another institution.

Students who interrupt their program and who must apply for readmission to the program will be required to comply with any new regulations upon resumption of their studies.

Breadth Requirements

Courses taken to fulfil the major, minor, or option requirements can also be used to satisfy breadth requirements.

Declaration of a Major and Minor

Students are advised to declare a primary major and minor, or primary major and a secondary major, or a major and two minors by the time they have completed 45 credits. Primary majors are selected from Science disciplines and consist of 42 to 60 junior- and senior-level credits; secondary majors can be from an Science or Arts discipline. Multi-disciplinary majors consist of 60-72 junior- and senior-level credits. Except for students in an Honours program, a maximum of 60 credits may be completed from any one discipline for credit towards the degree. A major and minor cannot be in the same discipline and students may not declare more than one out-of-faculty minor. Students can re-declare their major(s) and/or minor(s) if required.

For students completing multiple majors or minors, the Faculty cannot guarantee a schedule of classes that will permit students to complete their degree in eight consecutive fall and winter semesters. Furthermore, depending on the configuration of the student's degree, meeting the requirements for the degree may require the completion of more than 120 credits for graduation. Students are strongly encouraged to consult with an academic advisor in the Faculty of Arts and Science Advising Office and a discipline advisor in their major and minor prior to this declaration. Students majoring in mathematical or physical sciences may pursue a minor but are not required to do so.

Restricted Enrolment Courses

The Faculty of Arts and Science strives to accommodate all students wishing to enrol in a given course when it is appropriate to their program: however, classes in some courses must, for academic reasons, be restricted in size. If such a course is found to be oversubscribed, priority in registration will be given to those students whose programs may require it (e.g., majors, Honours, and/or minors) and then to other students as space permits.

Graduation Grade Point Average

As part of the Graduation Grade Point Average regulation above, Bachelor of Science students must obtain an overall GGPA of 2.0 or higher, with a minimum GPA of 2.0 on all courses credited toward the major(s) and a minimum GPA of 2.0 on all courses credited toward the minor(s).

Graduation Requirements

Graduation requirements are governed by the date on which a student declares their major(s) and minor(s). Students who declare their major(s) and minor(s) on or before the published deadline are bound by the requirements of the current academic year. Those students who declare after this date are bound by the programs of study and degree requirements of the upcoming academic year as published in the MacEwan Academic Calendar.

Junior - and Senior-Level Courses

Courses numbered from 100 to 199 are considered junior-level and courses numbered from 200 to 499 are considered senior-level.

Major or Minor 300- and 400- Level Requirements

The 300- and 400-level requirements in the major or minor cannot consist solely of project, field placement, and/or individual study courses.

Maximum Independent Courses

The maximum number of credits for independent work (project, field placement, and/or individual study courses) excluding the Honours Thesis, is 15 credits. Specific disciplines may have further restrictions.

Maximum Junior-Level Courses

A maximum of 48 credits at the 100-level are permitted in completion of the B.Sc. degree. Additional courses at the 100-level are extra to the 120 credits required to complete the B.Sc. degree and will not be counted toward fulfilment of graduation requirements.

Minimum Science Courses

Students are required to complete successfully a minimum of 72 total credits from Science courses.

Minimum Passing Grade

A minimum grade of D or credit CR is required for all Science degree courses unless otherwise noted next to the appropriate course in the program of study.

Minimum Transfer Grade for Credit

A minimum grade of D is required on any transfer credit granted for the program. Unless otherwise stated, Arts and Science courses require a minimum grade of C- when the course is used as a prerequisite. Transfer credit decisions made by the university are final and cannot be appealed.

Out-of-Faculty Options Requirements

Students may take a maximum of 18 credits from courses offered by a MacEwan University Faculty or School other than Arts and Science. Students completing an out-of-faculty minor or laddering students who have met the minor requirements with a MacEwan University diploma must complete their degree requirements from courses offered within the Faculty of Arts and Science or from the list of *Cross-Faculty Course Recognitions* in the Academic Calendar. Courses deemed as *Cross-Faculty*

Course Recognitions are used to fulfill in-Faculty courses within the BSc and do not count as out-of-Faculty options.

Progression of Studies

Students are responsible for ensuring they meet the prerequisite and/or co-requisite requirements as noted on all courses that may fulfill Bachelor of Science program requirements.

Honours Regulations

Overall Requirements

The Honours program of study consists of 63 to 84 credits as determined by the discipline. Students in the Honours program may choose to complete a minor outside of the Honours discipline. Some disciplines may require a minor.

Acceptance to Honours

For consideration of admittance/acceptance into Honours, students must present a minimum of 45 university-level credits applicable to the program of study, with a GPA of 3.0 or higher. They must complete 24 of the 45 credits in the last 12 months; however, exceptions to this rule may occur with the approval of the Honours discipline advisor. Individual departments may have additional requirements noted in their program of study.

Course Load

Students accepted into an Honours program must complete 24-credits in each twelve consecutive months they are in the program. Exceptions to this rule may occur with the approval of the Honours discipline advisor.

Grade Point Average

Students accepted and enrolled in the Science Honours program must maintain a minimum overall GPA of 3.0 across all courses in the degree. As well, students must maintain a minimum GPA of 3.3 across a set of courses designated by each discipline for each twelve consecutive months following acceptance into the Honours program. Failure to do so will result in the student's program status reverting to BSc with a major in the previous Honours discipline.

Graduation Grade Point Average

In order to graduate, students must obtain an overall GGPA of 3.0 or higher, with a minimum GPA of 3.3 on all courses credited toward the Honours program of study.

Program Learning Outcomes

Faculty of Arts and Science Degree-Level Learning Outcomes

Thinking about knowledge is at the core of University education and learning within the Faculty of Arts and Science. Students develop capacities to "think-through" - to practice wonder, reflection, and engage in thoughtful inquiry and dialogue. Thinking-through involves questioning beyond the confines of one's immediate personal, social, and disciplinary surroundings. First, knowledge is acquired and understood. Learning moves beyond acquiring information and data to a formally disciplined manner of thinking about knowledge. Next, knowledge is interrogated by asking and answering questions, distinguishing between opinion and knowledge, and developing tools to assess reasons and evidence. Finally, knowledge is synthesized as students develop coherent arguments, and link ideas together beyond what is immediately apparent. Learning is a lifelong creative process of discovery and action that happens beyond the classroom and the degree. Our graduates interact with and contribute to their community by integrating and applying the research and communication skills and ways of knowing developed through their education. Learning outcomes capture the observable knowledge, skills, and abilities graduates acquire that are the foundation of learning.

Graduates will demonstrate their ability to "think-through" by:

i. Analysing puzzles, problems, concepts, and theories.
ii. Conceptualizing questions based on disciplinary knowledge.
iii. Evaluating knowledge within and across disciplines in ways that acknowledge historical, cultural, and social contexts.

Graduates will demonstrate research and scholarship skills by:

iv. Applying appropriate research skills and ethical principles.
v. Interpreting results appreciating the value and limits of conclusions.
vi. Recognizing how research involves an ongoing process of reflection, dialogue, and reassessment.

Graduates will demonstrate diverse skills for communication by:

vii. Conveying complex ideas coherently in a variety of formats.
viii. Appraising information in ways that consider context and audience.
ix. Interpreting the ideas and arguments of others in ways that reflect their knowledge, judgement, and comprehension.

Graduates will demonstrate durable skills necessary for learning beyond their degree by:

x. Collaborating with diverse groups.
xi. Examining different perspectives and challenging biases and preconceptions.
xii. Exploring the continuous impact and limitations of disciplinary knowledge and expertise.

Mathematical Sciences Program Learning Outcomes

1. Remembering
Define mathematical, statistical, and computer science concepts clearly and concisely, and support them with examples.

2. Understanding
Show proficiency in mathematical, statistical, and computer science terms and concepts to follow and evaluate arguments by using different strategies across these disciplines. Have an awareness of questions to which the mathematical sciences can provide answers.

3. Creating and Applying
Develop a strategy to formulate and solve a mathematical sciences problem. Use a critical integrated knowledge system to form a judgement and apply it in formulating a mathematical sciences problem and use discipline-appropriate reasoning skills to solve the problem.

4. Analyzing
Analyze qualitatively diverse mathematical, statistical, and computer science representations using various processes.

5. Evaluating
Prove ability in applying mathematical, statistical, and computer science principles and processes in solving problems in the mathematical sciences, other disciplines, and everyday life.

Student Plan

- The student plan provides a suggested course sequence with the minimum number of credits required for the major
- The suggested course sequence depends on course availability, the student's schedule, and the student's choice of minor(s) or secondary major
- It is highly recommended that students complete their Breadth Requirements by the end of year 2
- The major is comprised of three disciplines - computer science, mathematics, and statistics. Students select two of the three as primary disciplines

Year 1	Credits
MATH 114	3
MATH 115	3
Choose 3 credits (1 course) from the following:	3
MATH 120	
MATH 125	
Choose 3 credits (1 course) from the following:	3
CMPT 101	
CMPT 103	
ENGL 102	3
Breadth Requirements	15
	30

Year 2	Credits
Choose 9 junior- or senior-level credits (3 courses) from the first primary discipline	9
Choose 9 junior- or senior-level credits (3 courses) from the second primary discipline	9
Breadth, Option, Minor(s), or Primary or Secondary Major Requirements	12
	30

Year 3	Credits
Choose 6 credits (2 courses) with a minimum of 3 credits (1 course) at the 300-level from the first primary discipline	6
Choose 6 credits (2 courses) with a minimum of 3 credits (1 course) at the 300-level from the second primary discipline	6
Choose 3 credits (1 course) from junior- or senior-level CMPT, MATH, or STAT	3
Options, Minor(s), or Primary or Secondary Major Requirements	15
	30

Year 4	Credits
Choose 6 senior-level credits (2 courses) with a minimum of 3 credits (1 course) at the 300- or 400-level from the first primary discipline	6
Choose 6 senior-level credits (2 courses) with a minimum of 3 credits (1 course) at the 300- or 400-level from the second primary discipline	6
Choose 3 credits (1 course) from junior- or senior-level CMPT, MATH, or STAT	3
Options, Minor(s), or Primary or Secondary Major Requirements	15
	30

Total Credits 120

Expected Course Offerings

Following is a list of expected course offerings for fall 2024 and winter 2025. While some might change, students can be assured that required courses will be available. Please refer to myStudentSystem for up-to-date course offerings.

Computer Science Course Offerings

Fall 2024

CMPT 101	Introduction to Computing I
CMPT 103	Introduction to Computing II
CMPT 200	Data Structures and Algorithms
CMPT 201	Practical Programming Methodology
CMPT 220	Unix, Scripting, and Other Tools
CMPT 230	Introduction to Computer Games
CMPT 250	Introduction to Human Computer Interaction
CMPT 272	Formal Systems and Logic in Computing Science
CMPT 291	Introduction to File and Database Management
CMPT 305	Introduction to Object-Oriented Programming
CMPT 310	Computers and Society
CMPT 340	Introduction to Numerical Methods
CMPT 360	Introduction to Operating Systems
CMPT 361	Introduction to Networks
CMPT 370	Introduction to Computer Graphics
CMPT 381	Cryptology from Classical to Post-Quantum
CMPT 395	Introduction to Software Engineering
CMPT 399	Topics in Computer Science
CMPT 430	3D Game Development and Artificial Intelligence
CMPT 480	Computer Network Security
CMPT 491	Datamining and Advanced Database Topics

Winter 2025

CMPT 101	Introduction to Computing I
CMPT 103	Introduction to Computing II
CMPT 200	Data Structures and Algorithms

CMPT 201	Practical Programming Methodology
CMPT 204	Algorithms I
CMPT 229	Computer Organization and Architecture
CMPT 250	Introduction to Human Computer Interaction
CMPT 272	Formal Systems and Logic in Computing Science
CMPT 280	Introduction to Computer Security
CMPT 312	Introduction to Robotics: Programming and Control
CMPT 315	Web Application Development
CMPT 330	Introduction to Real Time Gaming
CMPT 351	Introduction to Data Visualization
CMPT 355	Introduction to Artificial Intelligence
CMPT 360	Introduction to Operating Systems
CMPT 361	Introduction to Networks
CMPT 380	Computer Systems Security
CMPT 391	Database Management Systems
CMPT 395	Introduction to Software Engineering
CMPT 399	Topics in Computer Science
CMPT 455	Introduction to Machine Learning
CMPT 464	Wireless Networks and Embedded Systems

Mathematics Course Offerings

Fall 2024

MATH 099	Precalculus Mathematics
MATH 114	Elementary Calculus I
MATH 115	Elementary Calculus II
MATH 120	Basic Linear Algebra I
MATH 125	Linear Algebra I
MATH 200	Fundamental Concepts of Math
MATH 214	Intermediate Calculus I
MATH 223	Introduction to Combinatorics
MATH 225	Linear Algebra II
MATH 241	Geometry
MATH 310	Real Analysis
MATH 325	Matrix Theory and Applications
MATH 329	Abstract Algebra II
MATH 330	Ordinary Differential Equations
MATH 350	Introduction to Graph Theory
MATH 495	Special Topics in Mathematics

Winter 2025

MATH 099	Precalculus Mathematics
MATH 114	Elementary Calculus I
MATH 115	Elementary Calculus II
MATH 120	Basic Linear Algebra I
MATH 125	Linear Algebra I
MATH 200	Fundamental Concepts of Math
MATH 215	Intermediate Calculus II
MATH 225	Linear Algebra II
MATH 229	Abstract Algebra I
MATH 311	Theory of Functions of a Complex Variable
MATH 320	Elementary Number Theory
MATH 335	Numerical Methods
MATH 410	Analysis and Topology
MATH 429	Introduction to the Theory of Modules
MATH 430	Applied Dynamical Systems

Statistics Course Offerings

Fall 2024

STAT 151	Introduction to Applied Statistics
STAT 161	Applied Statistics for the Social Sciences
STAT 252	Applied Statistics II
STAT 265	Probability Theory I
STAT 370	Applied Time Series Analysis
STAT 371	Applied Categorical Data Analysis
STAT 378	Applied Regression Analysis

Winter 2025

STAT 151	Introduction to Applied Statistics
STAT 161	Applied Statistics for the Social Sciences
STAT 252	Applied Statistics II
STAT 265	Probability Theory I
STAT 266	Mathematical Statistics
STAT 350	Sampling Theory and Applications
STAT 395	Special Topics in Statistics at the intermediate level
STAT 412	Stochastic Processes
STAT 496	Statistical Consulting Project

Admission Requirements

Applicants may be admitted to one of the following:

Regular Admission

To be evaluated through the Office of the University Registrar

Applicants must have a minimum overall average of 65 percent, with no course grade lower than 50 percent, in the following high school courses:

1. ELA 30-1
2. Mathematics 30-1
3. Two of Biology 30, Chemistry 30, Mathematics 31, Physics 30, or Computing Science-Advanced Career and Technology Studies (5 credits)
4. One subject from Group A, B, C or D

Notes:

- A maximum of one Group D subject may be presented. Group D subjects used for admission must be 5-credit or any credit combination of at least 5 credits (e.g., two 3-credit subjects).

Applicants with nine to 23 university-level credits must also present a minimum Admission Grade Point Average (AGPA) of 2.0 on a 4.0 scale. Applicants with 24 or more university-level credits will be considered under Previous Post-Secondary Work.

Mature Admission

To be evaluated through the Office of the University Registrar

Applicants must be Canadian Applicants, 20 years of age or older, and have been out of full-time high school at least one year by the beginning of the intake term. Applicants must have a minimum overall average of 60 percent, with no course grade lower than 50 percent, in the following high school courses:

1. ELA 30-1
2. Mathematics 30-1
3. Two of Biology 30, Chemistry 30, Mathematics 31, Physics 30, or Computing Science-Advanced Level Career and Technology Studies (5 credits)

Applicants with nine to 23 university-level credits must also present a minimum Admission Grade Point Average (AGPA) of 2.0 on a 4.0 scale. Applicants with 24 or more university-level credits will be considered under Previous Post-Secondary Work.

Previous Post-Secondary Work

To be evaluated through the Office of the University Registrar

Admission in this category does not imply or guarantee the transfer of any coursework and/or credential unless a block transfer agreement (internal or external) is in effect and published in the calendar by the Office of the University Registrar. In addition, transfer of coursework does not imply or guarantee that an applicant will be admitted.

Applicants must have successfully completed the following:

- A minimum of 24 university-level credits, from a recognized institution, with a minimum Admission Grade Point Average (AGPA) of 2.0 on a 4.0 scale.
- The required mathematics and science courses listed under the Regular or Mature Admission category.

Additional Admission Criteria

All applicants must meet the following:

1. English Language Proficiency

To be evaluated through the Office of the University Registrar

Applicable to All Admission Categories

All applicants must meet an acceptable level of English language proficiency. We will require official documents such as high school or post-secondary transcripts or proof of successful completion of standardized language evaluation. Full details are available in MacEwan University's academic calendar or online at MacEwan.ca/ELP (http://MacEwan.ca/ELP/).

2. Other Admission Criteria

To be evaluated through the Office of the University Registrar

Applicable to All Admission Categories

Applicants who have been assigned two unsatisfactory academic records within the past five years will not be considered for admission or re-admission to the program until a minimum three years from the date of the assignment of the last unsatisfactory academic record. For the purpose of admission or re-admission, an unsatisfactory record is defined as a transcript with the notation 'required to withdraw' or equivalent.

Mathematical Sciences Courses

Computer Science Courses

CMPT 101
Introduction to Computing I
3 Credits Weekly (3-3-0)
This course provides a breadth-first introductory treatment of concepts in computing science for students with little or no programming background. Topics include data representation and machine architecture; algorithms and their properties; the control constructs of sequence, selection, and repetition; functions; and the notions of data type and operations on data types in low-level and high-level programming languages. Students do introductory programming for a portion of the course. Note: Students with no previous computing experience should enrol in CMPT 101 instead of CMPT 103. Credit cannot be obtained for CMPT 101 if credit has already been granted for CMPT 103.

CMPT 103
Introduction to Computing II
3 Credits Weekly (3-3-0)
This course continues the overview of computing science concepts that was started in CMPT 101. Topics include representation of compound data using abstraction, programming languages, and modularity; algorithms that use these data structures; and networks with the TCP/IP model and client/server architecture. Students continue with the syntax of a high-level programming language: functions, arrays, and user-defined data types.
Prerequisites: A minimum grade of C- in CMPT 101 or ENCP 100 or three credits of intermediate CSE including CSE 2120.

CMPT 104
Fluency with Information Technology
3 Credits Weekly (3-0-0)
This course introduces fundamental computational concepts. While some specific productivity software is covered, this is not a computer literacy course. The emphasis is on the concepts that underlie today's information infrastructure. Topics include abstraction, data representation and analysis, algorithms and algorithmic thinking, the Internet, and security.

CMPT 200
Data Structures and Algorithms
3 Credits Weekly (3-3-0)
This course continues the study of dynamic data structures (e.g., lists, stacks, queues, trees, and dictionaries) and associated algorithms (e.g., traversal, sorting, searching, element addition and removal). Recursion is covered, and some of the basic ideas of object-oriented programming, such as classes and objects, are introduced.
Prerequisites: Minimum grade of C- in CMPT 103.

CMPT 201
Practical Programming Methodology
3 Credits Weekly (3-3-0)
This course provides an introduction to the principles, methods, tools, and practices of the professional programmer. The lectures focus on best practices in software development and the fundamental principles of software engineering. The laboratories offer an intensive apprenticeship to the aspiring software developer. Students use C and the software development tools of the UNIX environment.
Prerequisites: Minimum grade of C- in CMPT 200.

CMPT 204
Algorithms I
3 Credits Weekly (3-0-1)
This is a first course on algorithm design and analysis with an emphasis on fundamentals of searching, sorting and graph algorithms. Examples of methodologies considered include divide and conquer, dynamic programming, and greedy methods, together with analysis techniques to estimate program efficiency.
Prerequisites: Minimum grade of C- in CMPT 200 and CMPT 272 or MATH 200 and MATH 113 or MATH 114 (Note: CMPT 272 is preferred to MATH 200).

CMPT 220
Unix, Scripting, and Other Tools
3 Credits Weekly (3-2-0)
The student is introduced to a Unix-like operating system along with some of its important design features, such as processes, pipes, and the I/O model. Some of the basic tools and methodologies are discussed, including shell scripts, editors, and standard utilities. Various open source tools are surveyed.
Prerequisites: Minimum grade of C- in CMPT 200.

CMPT 229
Computer Organization and Architecture
3 Credits Weekly (3-3-0)
This course provides a general introduction to number representation, the architecture and organization concepts of von Neumann machines, assembly level programming, exception handling, peripheral programming, floating point computations, and memory management.
Prerequisites: Minimum grade of C- in CMPT 200.

CMPT 230
Introduction to Computer Games
3 Credits Weekly (3-0-0)
This course is an introduction to various aspects of computer game design and marketing. It focuses on the history of computer games, computer game markets, evaluation of computer games, creation and testing of interactive narratives, and game interface design. The course includes a final capstone design for an interactive (narrative) game. Note: This course has a significant writing component; students are advised to take ENGL 102 (or equivalent) prior to taking this course.
Prerequisites: Minimum grade of C- in any CMPT *(*https://calendar.macewan.ca/course-descriptions/cmpt/*) or* ENGL *(*https://calendar.macewan.ca/course-descriptions/engl/*) course or in either PSYC 104 or PSYC 105.*

CMPT 250
Introduction to Human Computer Interaction
3 Credits Weekly (3-2-0)
This course introduces students to the basic components of the interaction design process. Effective user interaction design emphasizes the importance of good interfaces and the relationship of user interface design to human-computer interaction (HCI). The concept of interaction is introduced with a focus on the centrality of the user in HCI. Other topics include interface and interaction types, data gathering and analysis to understand and solve the design problem; design requirements, prototyping and usability testing. The lab allows the students to apply the concepts, tools and methods, discussed in lecture, towards the major course project. Note: In addition to the prerequisite, it is recommended that students taking this course have completed an additional computing science course or an introductory course in psychology, sociology, or anthropology. Note: Students who have received credit in DESN 240 or DESN 242 will not receive credit for CMPT 250.
Prerequisites: A minimum grade of C- in CMPT 101 or CMPT 103.

CMPT 272
Formal Systems and Logic in Computing Science
3 Credits Weekly (3-2-1)
This course provides an introduction to the tools of set theory, logic, and induction, and their use in the practice of reasoning about algorithms and programs. Topics include basic set theory, the notion of a function, counting, propositional and predicate logic and their proof systems, and inductive definitions and proofs by induction.
Prerequisites: A minimum grade of C- in CMPT 101 or CMPT 103 or CMPT 200 and a minimum grade of C- in MATH 114 and C- in MATH 120 or MATH 125.

CMPT 280
Introduction to Computer Security
3 Credits Weekly (3-1-0)
Students are introduced to computer and network security and the underlying concepts of confidentiality, integrity, and availability. Topics include common cyberattacks, identifying vulnerabilities and defending against attacks, and approaches to creating secure systems. Students also work with some of the tools available to security administrators.
Prerequisites: Minimum grade of C- in CMPT 200.

CMPT 291
Introduction to File and Database Management
3 Credits Weekly (3-3-0)
The course covers basic concepts in computer data organization and information processing, the entity-relationship model, the relational model, SQL, and other relational query languages. Other topics include storage architecture, physical organization of data, and access methods for relational data.
Prerequisites: A minimum grade of C- in CMPT 200.

CMPT 305
Introduction to Object-Oriented Programming
3 Credits Weekly (3-3-0)
In this course, students study the object-oriented programming (OOP) paradigm. The components of object-oriented programming are encapsulation, inheritance, and polymorphism. Students use some of the well established design patterns that recur in many non-trivial software systems. The last component of this course is event-driven programming. Note: Credit in CMPT 250 is recommended but not required.
Prerequisites: Minimum grade of C- in CMPT 200.

CMPT 306
Non-Procedural Programming Languages
3 Credits Weekly (3-3-0)
This course examines various programming languages other than the standard third generation languages such as C++ and Java. This course considers a functional language (Lisp) and a logic language (Prolog). The underlying theories of lambda calculus (Lisp) and predicate logic (Prolog) are also studied. A limited number of applications to Artificial Intelligence are considered for both languages. This course also may examine additional interpreted languages.
Prerequisites: Minimum grade of C- in CMPT 200 and CMPT 272.

CMPT 310
Computers and Society
3 Credits Weekly (3-0-0)
This course explores the social, legal and ethical issues arising in the wake of computer technology, especially those concerning self, community, environment, education, work and democracy. Topics include ethical frameworks; data collection and use; privacy and security; intellectual property; artificial intelligence and automation; social responsibility. Note: This is a third year course. It is recommended that students taking this course have at least 48 earned credits in their program of study.
Prerequisites: Minimum grade of C- in CMPT 200.

CMPT 311
Phenomenon of Technology
3 Credits Weekly (3-0-0)
This hybrid course explores the role and significance of technology in our daily lives through a variety of theoretical and research frameworks and methods, including media ecology, phenomenology, STS (science, technology and society) studies, and human-computer interaction research.
Prerequisites: Minimum grade of C- in any 200-level course (Note: this is a third year course, It is recommended that students taking this course have at least 48 credits in their program of study).

CMPT 312
Introduction to Robotics: Programming and Control
3 Credits Weekly (3-3-0)
This project based course offers an introduction to the basic concepts in robotics and the various algorithms used for perception, locomotion, and pathway planning. Students will get hands on experience with programming micro-controllers and building hardware and will apply concepts learned through interdisciplinary projects.
Prerequisite: A minimum grade of C- in CMPT 200.

CMPT 315
Web Application Development
3 Credits Weekly (3-3-0)
This course introduces various technologies in web programming. It requires students to work both individually and collaboratively to design and develop interactive web-based applications. Students learn both client- and server-side programming, database programming, and basic security concepts and testing.
Prerequisites: Minimum grade of C- in CMPT 291 and CMPT 305.

CMPT 330
Introduction to Real Time Gaming
3 Credits Weekly (3-3-0)
This course introduces the basic concepts of 2D and 3D game writing. Students learn to handle sprite animation, collision detection, and simple game artificial intelligence, and gain an understanding of the basics of 2D and 3D display at the level of the game engine. During this course, students design and implement an effective user interface for a game using a game engine as well as create several very small games. The course culminates with a team-based major game project.
Prerequisites: Minimum grade of C- in CMPT 230 and CMPT 305.

CMPT 340
Introduction to Numerical Methods
3 Credits Weekly (3-2-0)
This course provides an overview of computational methods for solving problems in linear algebra, non-linear equations, interpolation and approximation, and integration. Computer arithmetic and errors are discussed. The aim is to teach students the proper use of mathematical packages currently available.
Prerequisites: Minimum grades of C- in CMPT 201, MATH 114, and one of MATH 120 or MATH 125.

CMPT 351
Introduction to Data Visualization
3 Credits Weekly (3-2-0)
This course introduces techniques and tools for creating effective visualizations based on principles from visual design, perceptual psychology, and cognitive science. The goal of this course is to expose students to visual representation methods and techniques that increase the understandability of complex and varied data.
Prerequisites: Minimum grades of C- in CMPT 250 and STAT 151.

CMPT 355
Introduction to Artificial Intelligence
3 Credits Weekly (3-3-0)
This course provides an introduction to Artificial Intelligence (AI). AI is the study of how human intelligence can be imitated by computer programs. The course presents a survey of the concepts and applications of AI - such as: intelligent agents, knowledge representation, state-space search, expert systems and shells, natural language processing, propositional logic, learning and cognitive models. Some of the AI techniques will be implemented using both procedural and non-procedural languages (Prolog and LISP). Note: Students should be able to program in a high level programming language that allows explicit access to the underlying memory model. C and C++ are acceptable languages.
Prerequisites: Minimum grade of C- in CMPT 201 and CMPT 272.

CMPT 360
Introduction to Operating Systems
3 Credits Weekly (3-3-0)
This course introduces the fundamentals of operating systems. Topics include scheduling, memory management, concurrency, security and protection, device management, and file systems. The laboratory component involves both the investigation of these concepts in current operating systems as well as their design and implementation.
Prerequisites: Minimum grade of C- in CMPT 201.

CMPT 361
Introduction to Networks
3 Credits Weekly (3-3-0)
This course introduces the basics of networking with a focus on computer networks. Topics include network architectures, protocols, client-server programming, security, and network management. A selection of material from data compression and decompression and multimedia data technologies are also discussed.
Prerequisites: Minimum grade of C- in CMPT 201.

CMPT 370
Introduction to Computer Graphics
3 Credits Weekly (3-3-0)
This course introduces students to the foundations of computer graphics. Topics covered include 2D and 3D transformations, interactive 3D graphics programming, shading and lighting models, geometric modelling, computer graphics rendering including ray tracing and texture mapping. There will be an emphasis on both the mathematical and geometric aspects of graphics, as well as the ability to write complete 3D graphics programs.
Prerequisites: Minimum grades of C- in CMPT 201, MATH 114, and in either MATH 120 or 125.

CMPT 380
Computer Systems Security
3 Credits Weekly (3-3-0)
Students are introduced to the principles and practice of computer systems security and get hands on experience with relevant tools used by security professionals. Students also write programs to illustrate vulnerabilities and attacks such as: buffer overflow, SQL injection, cross site scripting and cross site request forgery. Topics include: host and application threats and hardening, storage security, virtualization, secure software development and web and mobile security.
Prerequisites: A minimum grade of C- in CMPT 280 and CMPT 360.

CMPT 381
Cryptology from Classical to Post-Quantum
3 Credits Weekly (3-3-0)
Cryptographic algorithms are used to ensure the privacy and integrity of data, secure communications, and protect and even supplant currency altogether. However, their utility and ubiquity were recently threatened by developments in quantum computing, necessitating a near future shift to more sophisticated, quantum-resistant algorithms. In this course, students will study the evolution of cryptology, covering the essentials of classical and contemporary symmetric and asymmetric encryption and decryption algorithms in their many forms and applications. In addition, students will study the implications of quantum attacks and explore at least one newly certified quantum-resistant algorithm. The focus of the course will balance practical implementations of naturally theoretical and mathematical concepts.
Prerequisites: Minimum grades of C- in CMPT 200 and one of MATH 120 or MATH 125.

CMPT 391
Database Management Systems
3 Credits Weekly (3-2-0)
This is the second course in database management systems. Topics include database design, normalization theory, transaction management, query processing, and query optimization, building and supporting secure applications. Database support for special data types such as XML documents is considered. Support for complex applications, data analysis and information retrieval is also covered.
Prerequisites: A minimum grade of C- in CMPT 291.

CMPT 395
Introduction to Software Engineering
3 Credits Weekly (3-3-0)
This course is an introduction to the fundamental concepts of software engineering. Topics include software design and analysis, software process, requirements, design patterns and testing. Team management is considered in both the lecture and in the laboratory through the use of team projects.
Prerequisites: Minimum grade of C- in CMPT 201.

CMPT 398
Independent Study
3 Credits Total (0-0-45)
This course permits an intermediate-level student to work with an instructor to explore a specific topic in depth through research or directed reading in primary and secondary sources. The student plans, executes and reports the results of their independent research or study project under the direction of a faculty supervisor. To be granted enrolment in the course, the student must have made prior arrangements with a faculty member willing to supervise the student's project.

CMPT 399
Topics in Computer Science
3 Credits Weekly (3-3-0)
In this course, students examine one or two topics in computer science. Topics will vary from year to year, but will typically build upon material students will have seen in the second year of their studies. Consultation with the department is required prior to registration. Note: This course may be taken multiple times for credit.
Prerequisites: Consent of the department.

CMPT 430
3D Game Development and Artificial Intelligence
3 Credits Weekly (3-3-0)
Modern game engines provide basic components such as animation and physics but to create a good game, the developer needs to provide functionality beyond the basics. This course will focus non-basic features such as camera control and game search/tracking heuristics. For the major project students will develop a portion of a game level using an existing commercial game engine. Note: CMPT 370 is recommended.
Prerequisites: Minimum grade of C- in both CMPT 330 and CMPT 395.

CMPT 450
Information Visualization
3 Credits Weekly (3-3-0)
This course continues the examination of human-computer interaction (HCI) that was begun in CMPT 250, but with the emphasis moving to the design and implementation of interactive visualization systems. Topics include design principles in information visualization, abstraction of data and user tasks, visual encoding, interaction techniques, and visualization toolkits.
Prerequisites: Minimum grade of C- in CMPT 250 and CMPT 305.

CMPT 455
Introduction to Machine Learning
3 Credits Weekly (3-3-0)
Machine learning (ML) is the science of making computers perform tasks without being explicitly programmed. There is a multitude of real-world applications of ML (e.g. speech recognition, advanced web search and information retrieval, self-driven cars). ML is used in almost any computer application without even knowing it. This class teaches the most effective machine learning techniques, along with practical skills to implement and adapt them to new problems.
Prerequisites: Minimum grades of C- in either CMPT 340 and STAT 151, or MATH 335 and CMPT 200.

CMPT 464
Wireless Networks and Embedded Systems
3 Credits Weekly (3-3-0)
This course introduces selected topics in embedded systems and wireless networks. Topics include an introduction to embedded systems with an emphasis on microcontrollers, techniques for programming embedded systems, design for low-power applications, the basics of radio communication, and protocols for both medium access control and routing within static and mobile environments. The laboratory is oriented toward the design and implementation of lecture topics using wireless sensor network hardware.
Prerequisites: Minimum grade of C- in CMPT 395 and C in CMPT 201.

CMPT 470
Introduction to Computer Vision
3 Credits Weekly (3-3-0)
Computer vision is a research field aimed to enable computers to process and interpret visual data, as sighted humans can. It is one of the most exciting areas of research in computing science and among the fastest growing technologies in today's industry. This course provides an introduction to the fundamental principles and applications of computer vision. Topics include feature detection and tracking, image matching and alignment, geometric relationships between 2D images and the 3D world, and some machine learning methods for computer vision.
Prerequisites: Minimum grades of C- in either CMPT 340 and STAT 151, or MATH 335 and CMPT 200.

CMPT 480
Computer Network Security
3 Credits Weekly (3-3-0)
Students are introduced to the principles and practice of computer networks security and get hands-on experience with relevant tools used by security professionals. Students also write code to illustrate vulnerabilities and attacks such as packet spoofing, ARP poisoning and DNS cache poisoning. Topics include network threats, hardening and monitoring, internet service hardening and network intrusion prevention and detection.
Prerequisites: Minimum grades of C- in CMPT 280 and CMPT 361.

CMPT 491
Datamining and Advanced Database Topics
3 Credits Weekly (3-3-0)
This course on data mining introduces the concepts, algorithms, techniques, and systems of data warehousing. Topics include what data mining is, data preprocessing, integration, and transformation. The design and implementation of data warehouse and OLAP systems, mining frequent patterns and association (basic concepts and advanced methods), and classification, clustering and outlier analysis are covered.
Prerequisites: Minimum grades of C- in STAT 151, CMPT 291, and in a 300-level CMPT *(*https://calendar.macewan.ca/course-descriptions/cmpt/*) course.*

CMPT 496
Final Project
3 Credits Total (0-0-60)
In this course, students plan, conduct, and communicate the results of an independent project in Computer Science under the direction of a faculty supervisor. The project can be undertaken by an individual student or, if the scope warrants, by a team of students. Registration is contingent on the student(s) having made prior arrangements with a faculty member willing to supervise the project. Note: This course is intended for students in the final year of their degree. This course may be taken twice for credit.
Prerequisites: Minimum grade of C- in CMPT 395 and consent of the department.

CMPT 497
Computer Science Internship
3 Credits Total (45-0-90)
This course provides students with practical experience in a work environment. Students engage in work integrated learning through employment or internship in industry. Students learn in practice the professional aspects (work and ethics) of a computer scientist. At the end of the placement, students provide a presentation to demonstrate the learning accomplished. The contact hours are a minimum of 90 hours but can involve more depending on the placement. This course may be taken two times for credit. All placements require departmental approval.
Prerequisites: A minimum grade of C- in CMPT 395 and consent of the Department.

CMPT 498
Advanced Independent Study
3 Credits Total (0-0-45)
This course permits a senior-level student to work with an instructor to explore a specific topic in depth through research or directed reading in primary and secondary sources. The student plans, executes and reports the results of their independent research or study project under the direction of a faculty supervisor. To be granted enrolment in the course, the student must have made prior arrangements with a faculty member willing to supervise the student's project.

CMPT 499
Topics in Computer Science
3 Credits Weekly (3-0-0)
In this course, students examine a topic of specialization in computer science. Topics will vary from year to year. Consultation with the department is required prior to registration. Note: This course may be taken multiple times for credit.
Prerequisites: Consent of the department.

Mathematics Courses

MATH 099
Precalculus Mathematics
3 Credits Weekly (3-0-0)
This course reviews and extends the mathematical concepts needed to be successful in university level calculus. Topics include graphing, equations of lines, inequalities, review of elementary algebra, functions, and trigonometry. MATH 099 cannot be used to fulfill the requirements of the Bachelor of Arts, the Bachelor of Commerce, or the Bachelor of Science programs.
Prerequisites: Mathematics 30-1 or Mathematics 30-2.

MATH 100
Calculus I
3.5 Credits Weekly (3-1-0)
This course provides an introduction to the fundamentals of calculus. The students learn about rectangular coordinates, analytic geometry, transcendental functions, inverse functions, limits, continuity, derivatives and applications, Taylor polynomials, integration and applications. Note: This course is restricted to Engineering students. Credit can only be obtained in one of MATH 100 or MATH 113 or MATH 114.
Prerequisites: Mathematics 30-1 and Mathematics 31.

MATH 101
Calculus II
3.5 Credits Weekly (3-1.5-0)
This course provides a continuation of the study of Calculus. Students learn about techniques of integration, arc length, area of a surface of revolution, applications to physics and engineering, first order ordinary differential equations (separable and linear), infinite series, power series, Taylor expansions, polar coordinates, rectangular coordinates in R3, parametric curves in the plane and space (graphing, arc length, curvature), normal, binormal, tangent in R3. Note: This course is restricted to Engineering Program students. Credit can only be obtained in one of MATH 101 or MATH 115.
Prerequisites: Minimum grade of C- in MATH 100.

MATH 102
Applied Linear Algebra
3.5 Credits Weekly (3-1.5-0)
This course provides an introduction to the fundamentals of linear algebra and some of their applications. The course content includes vectors and matrices; solutions of linear equations; equations of lines and planes; determinants; matrix algebra, linear transformations and their matrices; general vector spaces and inner product spaces; orthogonality and Gram-Schmidt process; eigenvalues and eigenvectors; and complex numbers. Note: This course is restricted to Engineering students. MATH 100 may be taken as a co-requisite with consent of the department. The course may not be taken for credit if credit has already been obtained in MATH 120 or MATH 125.
Prerequisites: A minimum grade of C- in MATH 100.

MATH 114
Elementary Calculus I
3 Credits Weekly (4-0-0)
This course examines the fundamental concept of limits, differentiation and integration. Limits and differentiation of algebraic and trigonometric functions are studied along with applications including related rates, optimizing and curve sketching. This course concludes with a study of Riemann sums, the Fundamental Theorem of Calculus and substitution. Note: Students who have received credit in MATH 113 or MATH 100 may not take MATH 114 for credit.
Prerequisites: A minimum grade of 80% in Mathematics 30-1, or successful completion (50% or better) of Mathematics 31, or a minimum grade of C- in MATH 099, or successful completion of the MATH 114 gateway exam.

MATH 115
Elementary Calculus II
3 Credits Weekly (3-1-0)
This course investigates the differentiation and integration of trigonometric, exponential and logarithmic functions. Indeterminate forms and improper integrals are studied, as well as the techniques and applications of integration. Note: Credit can only be obtained in one of MATH 115 or MATH 101.
Prerequisites: A minimum grade of C- in MATH 114.

MATH 120
Basic Linear Algebra I
3 Credits Weekly (3-0-0)
This is an introduction to the basic notions and methods of linear algebra. Topics covered are: systems of linear equations, vectors in n-space, vector equations of lines and planes, dot product, cross product, and orthogonality, matrix algebra, invertibility of matrices, determinants, general vector spaces, basis and dimension, subspaces of n-space, rank, introduction to linear transformations, introduction to eigenvalues and eigenvectors, and applications. NOTE: This course cannot be taken for credit if credit has already been obtained in either of MATH 102 or MATH 125.
Prerequisites: Mathematics 30-1 or a minimum grade of 80% in Mathematics 30-2.

MATH 125
Linear Algebra I
3 Credits Weekly (3-0-0)
This is an enriched introduction to the basic notions and methods of linear algebra. Topics covered are: systems of linear equations, vectors in n-space, vector equations of lines and planes, dot product, cross product, orthogonality, matrix algebra, invertibility of matrices, determinants, general vector spaces, basis and dimension, subspaces of n-space, rank, introduction to linear transformations, introduction to eigenvalues and eigenvectors, and applications. NOTE: The course covers the same basic topics as MATH 120, however it is a more rigorous course, and selected topics and applications are covered in more depth.
Prerequisites: Mathematics 30-1.

MATH 160
Higher Arithmetic
3 Credits Weekly (3-0-0)
This course emphasizes the development of clarity in the understanding of mathematical ideas and processes, communication of these ideas to others, and application of these ideas to problem solving. Both inductive and deductive methods are explored in the study of elementary number theory, numeration systems, operations on integers and rational numbers, and elementary probability theory. Note: This course is offered to students who intend to pursue Elementary Education.
Prerequisites: Mathematics 30-1 or Mathematics 30-2 or successful completion of the gateway exam.

MATH 200
Fundamental Concepts of Math
3 Credits Weekly (3-0-0)
This course provides an introduction to axiomatic systems and mathematical proof. These ideas are developed using examples taken primarily from set theory and number theory.
Prerequisites: A minimum grade of C- in one of MATH 114, MATH 120, or MATH 125.

MATH 214
Intermediate Calculus I
3 Credits Weekly (3-1-0)
This course completes the study of single-variable calculus and introduces students to the basic concepts of multi-variable calculus. Topics in single-variable calculus include area and arc length of plane curves defined by parametric or polar equations, infinite series, and power series. Topics in multi-variable calculus include: vector functions and space curves, functions of several variables, and partial derivatives with applications.
Prerequisites: Minimum grade of C- in MATH 115, and in either MATH 120 or MATH 125.

MATH 215
Intermediate Calculus II
3 Credits Weekly (3-1-0)
This course continues the study of multivariable calculus. Topics include: curves, tangent vectors, arc length; integration in two and three dimensions; polar, cylindrical and spherical coordinates; line and surface integrals, Green's, divergence and Stokes' theorems; first and second order linear differential equations.
Prerequisites: A minimum grade of C- in MATH 214.

MATH 223
Introduction to Combinatorics
3 Credits Weekly (3-0-0)
This course is an introduction to Combinatorics covering permutations, combinations, binomial coefficients, the binomial theorem, the pigeonhole principle, inclusion-exclusion principle, generating functions, recurrences and applications to graph theory.
Prerequisites: A minimum grade of C- in any 100-level Mathematics course, not including MATH 160 or MATH 170.

MATH 225
Linear Algebra II
3 Credits Weekly (3-0-0)
This course introduces the theory of vector spaces, inner product spaces, linear transformations and diagonalization. Specific topics of study include Euclidean n-space, spaces of continuous functions, matrix spaces, Gram-Schmidt process, QR-factorization, least squares method, change of basis, eigenspaces, orthogonal diagonalization, quadratic forms, matrices of transformations and similarity. Various applications are presented.
Prerequisites: A minimum grade of C- in either MATH 120 or MATH 125.

MATH 228
Algebra: Introduction to Ring Theory
3 Credits Weekly (3-0-0)
This course is an introduction to the theory of rings including integral domains, division rings, ring homomorphisms, ideals, quotient rings, fields of quotients, rings of polynomials, irreducible polynomials, Euclidean domains and fields. Specific topics include the well-ordering axiom, the Binomial Theorem, the Euclidean algorithm, the Fundamental Theorem of Arithmetic, and the Chinese Remainder Theorem.
Prerequisites: Minimum grades of C- in either MATH 200 or MATH 241, and in either MATH 120 or MATH 125.

MATH 229
Abstract Algebra I
3 Credits Weekly (3-0-0)
This course is an introduction to the theory of rings and groups, including integral domains, division rings, ring homomorphisms, ideals, groups, subgroups, cyclic groups and group homomorphisms.
Prerequisites: Minimum grades of C- in MATH 200 and one of MATH 120 or MATH 125.

MATH 325
Matrix Theory and Applications
3 Credits Weekly (3-0-0)
This course develops the study of matrices and their applications by way of special classes of matrices and matrix structure theorems. The main application will be to optimization problems.
Prerequisites: Minimum grades of C- in MATH 225 and MATH 114.

MATH 329
Abstract Algebra II
3 Credits Weekly (3-0-0)
This course continues the study of Abstract Algebra begun in Math 229 and studies rings of polynomials, divisibility, irreducibility, quotient rings, Euclidean domains, PIDs and UFDs, normal subgroups, quotient groups and the Sylow theorems.
Prerequisites: A minimum grade of C- in MATH 229.

MATH 241
Geometry
3 Credits Weekly (3-0-0)
The course explores Euclidean Geometry as an axiomatic system, based on invariance under the group of isometries (rigid motions). The material includes congruence, parallelism, similarity, and the theory of measurements based on continuity axioms. The notion of circumference is introduced and treated rigorously. Problem solving is an important component of the course. The problems include proofs, finding loci, and constructions. Transformations in the Euclidean plane are used as a problem-solving tool.
Prerequisites: A minimum grade of C- in any 100-level MATH *(*https://calendar.macewan.ca/course-descriptions/math/*) course, not including MATH 160 or MATH 170.*

MATH 310
Real Analysis
3 Credits Weekly (3-0-1)
This course presents a rigorous treatment of limit processes in one variable. Topics include real numbers, sequences, limits, continuous functions, differentiation, the Riemann integral, and the topology of the real number system.
Prerequisites: Minimum grade of C- in MATH 214 and in MATH 200.

MATH 311
Theory of Functions of a Complex Variable
3 Credits Weekly (3-0-0)
This course provides an introduction to the fundamental concepts of single variable complex analysis. The main topics include analytic functions, complex power series, Cauchy's Integral Theorem, Cauchy's Integral Formula, the residue theorem and applications to improper real integrals and Fourier transforms.
Prerequisites: Minimum grade of C- in MATH 215.

MATH 320
Elementary Number Theory
3 Credits Weekly (3-0-0)
Elementary methods in number theory are presented. The following topics are included: divisibility, linear Diophantine equations, prime numbers, the fundamental theorem of arithmetic, congruences, the Chinese remainder theorem, Fermat's little theorem, arithmetic functions, Euler's theorem, primitive roots, and quadratic residues.
Prerequisites: Minimum grade of C- in MATH 200; a minimum grade of C- in MATH 228 is recommended.

MATH 321
Fields and Modules
3 Credits Weekly (3-0-0)
This course builds on the knowledge of rings and fields obtained in MATH 228, and introduces the student to basic module theory. Topics studied include finite fields, quadratic number fields and algebraic field extensions, the Fundamental Theorem of Algebra, modules, and Noetherian rings.
Prerequisites: Minimum grade of C- in MATH 225 and MATH 228.

MATH 330
Ordinary Differential Equations
3 Credits Weekly (3-2-0)
This course provides techniques for solving ordinary differential equations and systems of first order equations and investigates the qualitative nature of solutions of dynamical systems. Topics covered include first order equations, linear equations of higher order and linear dynamical systems with constant coefficients.
Prerequisites: Minimum grades of C- in MATH 214, and in either MATH 120 or MATH 125.

MATH 335
Numerical Methods
3 Credits Weekly (3-2-0)
This course presents numerical methods for solving problems in linear algebra, non-linear equations, interpolations, approximation of functions, differentiation and integration. The numerical algorithms are illustrated using an appropriate computer programming language and specific libraries.
Prerequisites: Minimum grades of C- in MATH 214, CMPT 101, and one of MATH 120 or MATH 125.

MATH 341
Modern Geometries
3 Credits Weekly (3-0-0)
This course explores Euclidean and Non-Euclidean plane geometries from the viewpoint of Klein's Erlangen program, based on invariance under groups of transformations in the extended complex plane. Mobius geometry is introduced, and Euclidean, hyperbolic, and elliptic geometries are studied as its subgeometries. The differences in axiomatics and results of the Euclidean and Lobachevsky – Bolyai geometries are discussed based on the disc model of hyperbolic geometry. Elliptic geometry is considered as another Mobius subgeometry.
Prerequisites: Minimum grades of C- in MATH 241, and in either MATH 120 or MATH 125.

MATH 350
Introduction to Graph Theory
3 Credits Weekly (3-0-0)
This course discusses graphs and digraphs, paths and cycles, trees, planarity, colouring problems and matching problems. In addition, graph algorithms and some applications to other disciplines are studied.
Prerequisites: Minimum grades of C- in either MATH 120 or MATH 125, and in either MATH 200 or MATH 222.

MATH 361
History of Mathematics
3 Credits Weekly (3-0-0)
The course is a survey of the history of mathematics from ancient times through the development of calculus and the origins of modern algebra in the nineteenth century. It emphasizes the events that led to the development of modern and classic mathematics from a problem solving perspective. Biographies of famous mathematicians complement the abstract concepts of mathematics.
Prerequisites: Minimum grade of C- in any two 200-level MATH *(*https://calendar.macewan.ca/course-descriptions/math/*) courses.*

MATH 398
Independent Study
3 Credits Total (0-0-45)
This course permits an intermediate-level student to work with an instructor to explore a specific topic from mathematics in depth through research or directed reading in primary and secondary sources. The student plans, executes and reports the results of their independent research or study project under the direction of a faculty supervisor. To be granted enrollment in the course, the student must have made prior arrangements with a faculty member willing to supervise his or her project. This course can be taken twice for credit.

MATH 410
Analysis and Topology
3 Credits Weekly (3-0-0)
This course continues the study of Analysis begun in MATH 310 and examines differentiation and integration in Rn. Specific topics covered will include: implicit and inverse functions theorems, Fubini's theorem, differential forms, and the generalized Stokes' theorem.
Prerequisites: Minimum grade of C- in MATH 225 and MATH 310.

MATH 420
Groups and Galois Theory
3 Credits Weekly (3-0-0)
This course is a treatment of symmetry, beginning with groups, then developing the ideas of Galois theory, and finishing with the quintic equation. Topics include groups, normal subgroups, quotient groups, Cayley's Theorem, the Class equation, permutations, group actions, the Sylow theorems, splitting fields, Galois extensions, the Main Theorem of Galois theory, Kummer extensions, cubic, quartic and quintic equations.
Prerequisites: Minimum grade of C- in MATH 321.

MATH 428
Introduction to Galois Theory
3 Credits Weekly (3-0-0)
This course is an introduction to Galois Theory, covering topics such as algebraic extensions, algebraic closure, splitting fields, Galois extensions, the Galois group, the fundamental theorem of Galois theory and solvability of polynomial equations via radicals.
Prerequisites: A minimum grade of C- in MATH 329.

MATH 429
Introduction to the Theory of Modules
3 Credits Weekly (3-0-0)
This course is an introduction into the theory of modules over rings and covers topics as modules, homomorphisms and isomorphisms, quotient modules, free modules, generators, tensor products, Noetherian rings and modules.
Prerequisites: A minimum grade of C- in MATH 329.

MATH 430
Applied Dynamical Systems
3 Credits Weekly (3-1-0)
This course presents an introduction to dynamical systems related to ordinary differential equations in the continuous case, or to difference equations in the discrete case. Elementary existence and uniqueness theorems and stability are considered for linear and non-linear systems of ordinary differential equations. Periodic solutions, chaotic attractors, an introduction to bifurcation theory, basic notions of discrete dynamical systems, and deterministic chaos are discussed. Applications are chosen from biology, physics and other areas.
Prerequisites: Minimum grade of C- in MATH 310 and MATH 330.

MATH 436
Introduction to Partial Differential Equations
3 Credits Weekly (3-2-0)
The goal of this course is to introduce the student to the mathematical modeling of classical physical systems such as vibrating systems, diffusive processes and steady state phenomena. The course starts with a rigorous introduction of the first-order and linear second-order partial differential equations (PDEs) followed by elements of Fourier analysis. The method of characteristics is used to find and interpret classes of solutions for the above models. The lab component will familiarize the student with formal and numerical manipulations of PDE's. The main scope of the lab is to enable the student to visualize and discuss solutions for classical models for PDE's.
Prerequisites: Minimum grades of C- in MATH 310 and MATH 330.

MATH 495
Special Topics in Mathematics
3 Credits Weekly (3-0-1)
This course examines an advanced topic of specialization in mathematics. The instructor chooses the topic in any given semester. Students can take this course up to three times, provided the course topic is different.
Prerequisites: A minimum grade of B- in a 300-level MATH *(*https://calendar.macewan.ca/course-descriptions/math/*) course and consent of the department.*

MATH 498
Advanced Independent Study in Mathematics
3 Credits Total (0-0-45)
This course permits a senior-level student to work with an instructor to explore a specific topic from mathematics in depth through research or directed reading in primary and secondary sources. The student plans, executes and reports the results of their independent research or study project under the direction of a faculty supervisor. To be granted enrollment in the course, the student must have made prior arrangements with a faculty member willing to supervise his or her project. This course can be taken twice for credit.

MATH 499
Honours Thesis
3 Credits Total (0-0-45)
Under the direction of a faculty supervisor, registered students explore a specific topic in depth through research or directed reading. The student plans, executes, and reports the results of their independent research or study project under the direction of a faculty supervisor in a written Honours Thesis with oral defense. Note: This course is intended for students in the final year of their degree and is open only to students in the Mathematics Honours program.
Prerequisites: Consent of the Department.

Statistics Courses

STAT 151
Introduction to Applied Statistics
3 Credits Weekly (3-1.5-0)
In this course the following topics are covered: data collection and presentation; descriptive statistics; probability distributions, sampling distributions and the central limit theorem; point estimation, confidence intervals, and hypothesis testing; one-way ANOVA; Chi-square tests; and correlation and regression analysis. Applications are taken from a broad variety of fields such as biological and medical sciences, engineering, social sciences and economics. Note: This course may not be taken for credit if credit has been obtained in Stat 161.
Prerequisites: Mathematics 30-1 or Mathematics 30-2 or successful completion of the statistics gateway exam.

STAT 161
Applied Statistics for the Social Sciences
3 Credits Weekly (3-1.5-0)
This course provides an introduction to descriptive and inferential statistics with a focus on data analytic tools particularly relevant in the social sciences. Topics covered in this course include descriptive statistics, basic probability theory and the central limit theorem; estimation and hypothesis testing; t-tests, analysis of contingency tables, one way ANOVA, and multiple linear regression analysis. Applications are taken from the social sciences and many other fields such as biological and medical sciences, engineering, and economics. Note: Credit cannot be obtained in both STAT 151 and 161.
Prerequisites: Mathematics 30-1 or Mathematics 30-2 or successful completion of the statistics gateway exam.

STAT 252
Applied Statistics II
3 Credits Weekly (3-2-0)
Fundamental methods in applied statistics are presented in this course including the following topics: factorial ANOVA and Linear Regression models and their analysis as well as non-parametric statistical tools for the comparison of the centre of distributions. Applications are taken from a broad variety of areas such as biological, social and computer sciences, engineering, and economics.
Prerequisites: A minimum grade of C- in one of STAT 151 or STAT 161.

STAT 265
Probability Theory I
3 Credits Weekly (3-0-1)
This course offers a calculus-based introduction to probability theory. Topics covered include sample space, events, combinatorial probability, conditional probability, independent events, Bayes' theorem, discrete and continuous random variables, univariate and multivariate probability distributions, expectation, conditional expectation, joint probability distributions, independence, moment generating functions. Note: STAT 151 is recommended and MATH 214 is a recommended corequisite.
Prerequisites: A minimum grade of C- in MATH 115.

STAT 266
Mathematical Statistics
3 Credits Weekly (3-1-1)
The emphasis of this course is to present the fundamental statistical concepts in estimation and hypothesis testing from a classical perspective using the tools of probability theory. Topics covered include: limit theorems, sampling distributions, methods of point estimation and properties of point estimators, interval estimation, testing hypotheses. Statistical software is used to simulate distributions and probabilistic processes that lead to statistical applications.
Prerequisites: Minimum grades of C- in STAT 265, STAT 151 or STAT 161, and in either CMPT 101 or CMPT 103.

STAT 312
Probability Theory II
3 Credits Weekly (3-0-0)
This course offers a rigorous approach to probability theory. Topics covered include concepts of probability theory, multivariate random variables, conditional expectation and variance, probability and moment generating functions, the multivariate normal distribution, different types of convergence and limit theorems, Poisson and branching processes.
Prerequisites: Minimum grades of C- in MATH 215, MATH 225, and STAT 265.

STAT 322
Finite Markov Chains and Applications
3 Credits Weekly (3-0-1)
This course presents fundamental results regarding finite Markov chains. Topics covered include connection with matrix theory, classification of states, main properties of absorbing, regular and ergodic finite Markov chains. Applications to genetics, psychology, computing science and engineering are also included.
Prerequisites: Minimum grades of C- in either MATH 120 or MATH 125, and in STAT 265; a minimum grade of C- in Math 214 is recommended.

STAT 324
Computational Statistics with R
3 Credits Weekly (2-2-0)
This course explores the usage of computer programming and algorithms in the field of statistics. The focus of the course will be computationally intensive statistical methods, such as Monte Carlo simulations, the expectation-maximization algorithm, and bootstrapping. The material will be illustrated and the students' work will be carried out using R (a free, open source, multi-platform programming language).
Prerequisites: Minimum grades of C- in STAT 266, and in either CMPT 101 or CMPT 103.

STAT 350
Sampling Theory and Applications
3 Credits Weekly (3-0-0)
This course concentrates on the design and analysis techniques for sample surveys. Topics include simple random sampling, stratified sampling, ratio, regression and difference estimation, single-stage cluster sampling, systematic sampling, two-stage cluster sampling.
Prerequisites: A minimum grade of C- in STAT 265.

STAT 353
Design and Analysis of Experiments
3 Credits Weekly (3-2-0)
This course deals with design, conduct and analysis of experimental studies. Topics include: principles of design, completely randomized design with one factor, randomized complete block designs, Latin square design, Graeco-Latin square design, balanced incomplete block design, factorial design, two-level factorial design, two-level factorial design in incomplete blocks, two-level fractional factorial design, experiments with random factors, and nested and split-plot designs.
Prerequisites: A minimum grade of C- in STAT 266.

STAT 370
Applied Time Series Analysis
3 Credits Weekly (3-2-0)
This is an introductory course in applied time series analysis. Topics include computational techniques in time domain for simple time series models. Model selection, estimation, and forecasting are illustrated for the autoregressive, moving average, ARMA, ARIMA and SARIMA models. Applications are taken from medical and social sciences, biology, engineering and business.
Prerequisites: Minimum grades of C- in STAT 266, MATH 214, and MATH 225.

STAT 371
Applied Categorical Data Analysis
3 Credits Weekly (3-2-0)
This course presents fundamental methods in categorical data analysis emphasizing applications. Topics include: analysis of two-way tables, models for binary response variables, loglinear models, and models for ordinal data and multinomial response data.
Prerequisites: A minimum grade of C- in either STAT 252 or STAT 266.

STAT 372
Applied Multivariate Statistics and Machine Learning
3 Credits Weekly (3-2-0)
This course focuses on essential multivariate statistical methods. Topics include matrix algebra, tests of significance, principal components analysis, factor analysis, discriminant analysis, cluster analysis and canonical correlation analysis. This course is relevant to working professionals in health, social biological and behavioral sciences who engage in applied research in their field.
Prerequisites: Minimum grades of C- in STAT 265, one of MATH 120 or MATH 125, and one of STAT 151 or STAT 161.

STAT 378
Applied Regression Analysis
3 Credits Weekly (3-2-0)
The course introduces methods in regression analysis. Topics include: multiple linear regression with particular focus on diagnostics, non-linear regression, and generalized linear models, such as Poisson regression and logistic regression. Emphasis will be placed on the practical application of the statistical methods.
Prerequisites: Minimum grades of C- in either STAT 266 or in all of STAT 252, MATH 114, and either MATH 120 or MATH 125.

STAT 395
Special Topics in Statistics at the intermediate level
3 Credits Weekly (3-0-1)
In this course students examine a topic in Statistics at the intermediate level. Topics vary and are announced prior to registration. Consult with faculty members in Statistics for details regarding current offerings. Note: This course may be taken multiple times for credit.
Prerequisites: A minimum grade of B- in STAT 265 and consent of the department.

STAT 398
Independent Study
3 Credits Total (0-0-45)
This course permits an intermediate-level student to work with an instructor to explore a specific topic in depth through research or directed reading in primary and secondary sources. The student plans, executes and reports the results of their independent research or study project under the direction of a faculty supervisor. To be granted enrollment in the course, the student must have made prior arrangements with a faculty member willing to supervise his or her project. This course can be taken twice for credit.
Prerequisites: Consent of the Department.

STAT 412
Stochastic Processes
3 Credits Weekly (3-2-0)
This course presents fundamental results regarding discrete and continuous time Markov chains, branching processes, random walks, birth and death processes, semi-Markov processes, and Brownian motions. A practical but rigorous approach to stochastic processes will be utilized, with a focus on building models and understanding them mathematically.
Prerequisites: Minimum grades of C- in CMPT 101 or CMPT 103, MATH 214, MATH 225, STAT 266, and an additional three credits in any 300-level STAT *(*https://calendar.macewan.ca/course-descriptions/stat/*) course.*

STAT 465
Probability Theory and Mathematical Statistics II
3 Credits Weekly (3-1-0)
This course offers a rigorous approach to probability theory and mathematical statistics. Topics include conditional expectation and variance, multivariate normal distribution, convergence, laws of large numbers, central limit theorem, maximum likelihood estimator and its properties, Delta method, likelihood ratio tests, Taylor and Edgeworth expansions.
Prerequisites: A minimum grade of C- in Math 225, STAT 266 and any 300-level statistics course.

STAT 478
Applied Generalized Linear Models
3 Credits Weekly (3-2-0)
The course introduces the theory of generalized linear models and their applications. Topics include exponential family of distributions, modeling binomial and count data, linear mixed models, gamma and inverse-Gaussian generalized linear models, and introduction to survival analysis. Emphasis will be placed on the practical application of the statistical methods.
Prerequisites: A minimum grade of C- in both STAT 266 and STAT 378.

STAT 495
Special Topics in Statistics
3 Credits Weekly (3-0-1)
In this course, students examine an advanced topic in Statistics. Topics vary and are announced prior to registration. Consult with faculty members in Statistics for details regarding current offerings. Note: This course may up to three times for credit provided the topic is different.
Prerequisites: Minimum grade of B- in a 300-level STAT *(*https://calendar.macewan.ca/course-descriptions/stat/*) course and consent of the department.*

STAT 496
Statistical Consulting Project
3 Credits Total (0-0-45)
The aim of the course is to provide students with experience in statistical consultation. Students are assigned to research projects as consultants, which requires them to consider ethical statistical practice, choose the appropriate statistical technique, and communicate the results to a non-mathematical audience.
Prerequisites: A minimum grade of C- in two 300-level STAT *(*https://calendar.macewan.ca/course-descriptions/stat/*) courses and consent of the department.*

STAT 498
Advanced Independent Study
3 Credits Total (0-0-45)
This course permits senior-level students to work with an instructor to explore a specific topic in depth through research or directed reading in primary and secondary sources. The student plans, executes and reports the results of their independent research or study project under the direction of a faculty supervisor. To be granted enrollment in the course, the student must have made prior arrangements with a faculty member willing to supervise his or her project. This course can be taken twice for credit.

STAT 499
Honours Thesis
3 Credits Total (0-0-45)
Under the direction of a faculty supervisor, registered students explore a specific topic in depth through research or directed reading. The student plans, executes, and reports the results of their independent research or study project under the direction of a faculty supervisor in a written Honours Thesis with oral defense. Note: This course is intended for students in the final year of their degree and is open only to students in the Applied Statistics Honours program.
Prerequisites: Consent of the Department.