CHEMISTRY - BACHELOR OF SCIENCE

Overview

The Chemistry Major is a modern and adaptable program. It provides students with the theoretical knowledge and applied laboratory skills necessary to be successful in industry, academia, or professional programs, and culminates with the potential for students to fulfill the requirements to attain the designation of professional chemist (P.Chem.). Students will take introductory coursework in all five major chemistry subdisciplines (analytical, inorganic, physical, organic, and biochemistry), followed by senior-level coursework in a diverse array of modern chemistry fields, including industrial, environmental, geological, green, forensic, materials, and medicinal chemistry. The theoretical knowledge gained from this coursework combined with a robust and practical laboratory program, gives students relevant, hands-on skills and techniques used in modern academic and industrial settings. The requirement of either independent research or an industrial internship solidifies the practical learning experience for our students.

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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 declaration period for noncompetitive majors and minors is between September 1 and February 15 and between September 1 and January 15 for competitive majors and minors. 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

Chemistry Requirements

Chemistry Major

Chemistry Minor

Chemistry Major

The Bachelor of Science (BSc) in Chemistry program requires students to complete 120 credits of non-duplicative coursework. In addition to the Chemistry Major, students will complete one of the following:

- one minor,
- two minors, or
- a secondary Science major

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

The Chemistry Major is 48 to 60 credits with a minimum of 39 senior-level CHEM or BICM credits. Students are required to complete a minimum of 12 credits of CHEM or BICM courses at the 300-level, and a minimum of nine credits of CHEM courses at the 400-level. The 400-level CHEM requirement includes CHEM 497 or CHEM 498. Students can use only two independent courses to fulfill the 400-level requirements.

Note: Students majoring in Chemistry are required to complete BIOL 107, MATH 114, MATH 115, STAT 151, and six credits of junior-level Physics from either PHYS 124 and PHYS 126, or PHYS 144 and PHYS 146.

Bachelor of Science - Chemistry Major

Code	Title	Credits
Specific Major Requirements		
CHEM 101	Introductory University Chemistry I	3
CHEM 102	Introductory University Chemistry II	3
CHEM 211	Applied Analytical Chemistry	3
CHEM 232	Inorganic Chemistry	3
CHEM 242	Fundamentals of Physical Chemistry	3
CHEM 261	Organic Chemistry I	3
CHEM 263	Organic Chemistry II	3
Choose 3 credits from the following:		3
CHEM 496	Techniques in Applied Laboratory Chemistry	
CHEM 497	Chemistry Internship Practicum	
CHEM 498	Advanced Independent Study	
BICM 200	Introductory Biochemistry	3

SCIE 201	Scientific Process: From Research Questions to Printed Manuscript	3
General Major Requirements		
Choose 18 to 30 credits from senior-level CHEM or BICM. Students can also use PHSC 200 to fulfill the general major requirements.		18-30
Secondary Major or Minor(s)		
Students have the option of completing a second Science major, or one or two minors. Minor courses must be completed at the senior-level.		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.		0-60
Total Credits		**120**

Chemistry Minor

The Chemistry Minor requires 18 senior-level credits with a minimum of six credits at the 300- or 400-level. A maximum of three credits in PHSC may be used.

Note: CHEM 101 and CHEM 102 are required for this minor.

Code	Title	Credits
Minor Requirements		
Choose 18 credits from senior-level CHEM; a maximum of 3 credits in PHSC may be used		18
Total Credits		**18**

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.

Chemistry Major Learning Outcomes

1. Demonstrate a mastery of the underlying concepts, principles, and applications of the fundamental subdisciplines of chemistry (analytical, biochemistry, inorganic, organic, and physical chemistry).
2. Independently apply analytical, critical thinking, and problem-solving skills to address chemistry-related problems.
3. Demonstrate proficiency in the use of standard laboratory equipment and classical laboratory techniques, and demonstrate knowledge in the use, theory, and application of modern chemistry laboratory techniques and instrumentation.
4. Design and perform experiments in a range of chemistry fields; independently interpret, critically assess and communicate the results of experiments; synthesize and integrate current research into the design and interpretation of experiments.
5. Perform experiments utilizing chemistry laboratory best practices, including laboratory safety and safe chemical handling, laboratory quality assurance and quality control procedures, and legal and ethical issues in chemistry.
6. Prepare and present the results of experiments in a variety of formats (oral and written), such that the results are meaningful and can be understood by audiences with a broad range of backgrounds.
7. Use modern information resources to gather and evaluate relevant chemical information and chemistry related research.
8. Explain, describe, and assess the role and applications of chemistry in modern society.
9. Effectively integrate and appropriately apply previous learning and knowledge to make and justify decisions in a real-world context outside of the classroom.

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

Year 1	Credits
CHEM 101	3
CHEM 102	3
BIOL 107	3
MATH 114	3
STAT 151	3
PHYS 124	3
PHYS 126	3
ENGL 102	3
Breadth Requirements	6
	30

Year 2	Credits
CHEM 211	3
CHEM 232	3
CHEM 242	3
CHEM 261	3
CHEM 263	3
MATH 115	3
SCIE 201	3
Breadth, Option, Minor(s), or Primary or Secondary Major Requirements	9
	30

Year 3	Credits
BICM 200	3
Choose 9 credits (3 courses) from 300-level CHEM	9
Breadth, Option, Minor(s), or Primary or Secondary Major Requirements	18
	30

Year 4	Credits
Choose 3 credits (1 course) from the following:	3
CHEM 496	
CHEM 497	
CHEM 498	
Choose 3 credits (1 course) from 300-level CHEM or BICM	3
Choose 6 credits (2 courses) from 400-level CHEM or BICM	6
Options, Minor(s), or Primary or Secondary Major Requirements	18
	30

Total Credits 120

Expected Course Offerings

Following is a list of expected course offerings for fall 2024 and winter 2025. We will update the list with expected courses scheduled for fall 2025 and winter 2026 in February 2024. While some might change, students can be assured that required courses will be available.

Fall 2024

CHEM 101	Introductory University Chemistry I
CHEM 102	Introductory University Chemistry II
CHEM 211	Applied Analytical Chemistry
CHEM 242	Fundamentals of Physical Chemistry
CHEM 261	Organic Chemistry I
CHEM 263	Organic Chemistry II
CHEM 320	Introduction to Geochemistry
CHEM 333	Organometallic Chemistry
CHEM 353	Forensic Chemistry
CHEM 372	Environmental Chemistry
CHEM 391	Applied Spectroscopy
CHEM 464	Advanced Synthetic Medicinal Chemistry

Winter 2025

CHEM 101	Introductory University Chemistry I

CHEM 102	Introductory University Chemistry II
CHEM 232	Inorganic Chemistry
CHEM 261	Organic Chemistry I
CHEM 263	Organic Chemistry II
CHEM 311	Advanced Chemical Analysis
CHEM 322	Introduction to Biogeochemistry
CHEM 342	Materials Chemistry
CHEM 364	Introduction to Medicinal Chemistry
CHEM 380	Process and Flow Chemistry
CHEM 466	Modern Catalysis
CHEM 472	Advanced Environmental Chemistry
CHEM 496	Techniques in Applied Laboratory Chemistry
CHEM 497	Chemistry Internship Practicum

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.

Chemistry Courses

CHEM 101
Introductory University Chemistry I
3 Credits Weekly (4-3-0)
This course serves as a foundation for all subsequent chemistry courses. Atomic properties as they relate to the periodic table are considered, along with quantum mechanics for hydrogen-like orbitals and electron configurations. The course provides an introduction to bonding theories as they apply to the stability, molecular geometry and intermolecular interactions of atomic, ionic and molecular species. Topics include chemical nomenclature, stoichiometry, classification of chemical reactivity, gases (both ideal and real) and thermochemistry. Note: Credit may be obtained in only one of CHEM 101 or CHME 103.
Prerequisites: Chemistry 30.

CHEM 102
Introductory University Chemistry II
3 Credits Weekly (4-3-0)
This course emphasizes the importance of chemical equilibrium as it applies to gases, acids and bases, solubility and precipitation reactions and complex ion formation. Also studied are kinetics (rates of reactions, differential and integrated rate laws, the Arrhenius equation), catalysts, thermodynamics (spontaneity, entropy, free energy), and electrochemistry (balancing redox reactions, calculating standard and non-standard cell potentials), with emphasis on some practical applications related to batteries, corrosion and industrial processes. A special topic, selected by the instructor, is covered if time permits. Note: Credit may only be obtained in one of CHEM 102 or CHME 105.
Prerequisites: Minimum grade of C- in CHEM 101.

CHEM 211
Applied Analytical Chemistry
3 Credits Weekly (3-4-0)
This course surveys the principles, methods, and experimental applications of classical analytical chemistry, emphasizing solution phase equilibria, titrimetry, volumetric laboratory skills, and the evaluation of experimental data. This course includes real life examples of organic and inorganic analysis and analytical chemistry literature. Students are introduced to principles, methods, and experimental applications of separation techniques, atomic and molecular spectrometry, potentiometry, and the evaluation of experimental data.
Prerequisites: Minimum grade of C- in CHEM 102 or CHME 105.

CHEM 232
Inorganic Chemistry
3 Credits Weekly (3-3-0)
This course examines the bonding models used for inorganic compounds (main group and transition metal elements). Reactivity patterns of inorganic compounds are considered to gain an understanding of the role of thermodynamics and kinetics in their preparation and reactivity. Physical methods that are used to characterize inorganic compounds are discussed. The relevance and importance of inorganic compounds in the environment, industry and biology are emphasized.
Prerequisites: Minimum grade of C- in CHEM 102.

CHEM 242
Fundamentals of Physical Chemistry
3 Credits Weekly (3-3-0)
This course is about the use of methods to design experiments, analyze measured data, and devise quantitative models in chemistry. These models are applied to explain observations, to optimize experimental conditions, and to predict and control the direction, extent and rate of physicochemical processes. Internal energy, enthalpy, entropy and free energy functions are applied to perform the materials and energy balances of reactions, phase transitions, transport of matter, and coupled processes thereof. Focus is placed on nonequilibrium and steady-state processes. The laws of energy conservation, entropy production, and equilibrium are applied to phenomena occurring inside systems consisting of several components and phases. Fundamentals cover the methods to determine the kinetic parameters and mechanism of chemical reactions.
Prerequisites: A minimum grade of C- in CHEM 102 and MATH 114.

CHEM 261
Organic Chemistry I
3 Credits Weekly (3-3-0)
This course covers the molecular structure and reactivity of organic compounds based on their functional groups. The course provides an introduction to nomenclature, three dimensional structure and physical properties of organic compounds as well as reaction mechanisms and infrared spectroscopy. Although most organic functional groups are discussed, the focus is on the chemistry of alkanes, alkenes, alkynes and alkyl halides. Mechanisms of nucleophilic substitution and elimination reactions of alkyl halides are discussed.
Prerequisites: Minimum grade of C- in either CHEM 102 or CHME 105.

CHEM 263
Organic Chemistry II
3 Credits Weekly (3-3-0)
The nomenclature, structure, physical properties, synthesis and selected reactions of the basic functional groups in organic chemistry are discussed. Functional groups covered include alkenes, alkynes, aromatic compounds, alcohols, phenols, ethers, aldehydes, ketones, amines, carboxylic acids and carboxylic acid derivatives. An emphasis will be placed on understanding the fundamental mechanistic processes behind these chemical transformations. The application of spectroscopic methods for structure determination in simple organic molecules is discussed.
Prerequisites: Minimum grade of C- in CHEM 261.

CHEM 311
Advanced Chemical Analysis
3 Credits Weekly (3-4-0)
This course discusses instrumentation and analytical applications of spectroscopic, chromatographic, and electroanalytical methods. The theory governing each analytical technique and its advantages and disadvantages are discussed. Emphasis is placed on choosing the appropriate method for a particular analysis.
Prerequisites: A minimum grade of C- in one of CHEM 211, CHEM 270, or CHEM 372.

CHEM 320
Introduction to Geochemistry
3 Credits Weekly (3-3-0)
This course provides an introduction to the interdisciplinary science of geochemistry. The first part of the course examines our home planet from a geochemical perspective and includes formation of the Earth and our solar system, the origin of the elements and their distribution within the Earth, and evolution of the crust, mantle and core. An introduction to the essential geochemical tools of thermodynamics and kinetics, isotope geochemistry and trace element geochemistry is also provided. The second part of the course examines the geochemistry of igneous, sedimentary and metamorphic rocks and covers topics as diverse as the melting and crystallization of rocks to the contamination of our water supplies and the stability of carbonates in our oceans. Note: Credit can only be obtained in one of CHEM 320 or EASC 320.
Prerequisites: Minimum grades of C- in a 200-level CHEM *(*https://calendar.macewan.ca/course-descriptions/chem/*) course and a 200-level* EASC *(*https://calendar.macewan.ca/course-descriptions/easc/*) course.*

CHEM 322
Introduction to Biogeochemistry
3 Credits Weekly (3-3-0)
Biogeochemistry is the study of the chemical, physical, geological, and biological processes and reactions that govern planet Earth. This course provides an introduction to the discipline, focusing on the exchange of energy and elements between the biosphere and the geosphere. The fundamental components of the Earth's system are examined, including the atmosphere, hydrosphere, biosphere, and geosphere, alongside their evolutionary histories and linkages. Topics include the principle biogeochemical cycles, such as the carbon, sulfur, and nitrogen cycles, and their histories. These cycles are assessed in the context of recent environmental and climate change driven by anthropogenic activities. This course incorporates a multitude of disciplines, spanning geology, chemistry, biology, and environmental science. Note: Credit cannot be obtained in both CHEM 322 and EASC 322.
Prerequisites: Minimum grades of C- in a 200-level CHEM *(*https://calendar.macewan.ca/course-descriptions/chem/*) course and a 200-level* EASC *(*https://calendar.macewan.ca/course-descriptions/easc/*) course.*

CHEM 333
Organometallic Chemistry
3 Credits Weekly (3-3-0)
This course surveys the basic principles of the organometallic chemistry as they apply to metals of the d-block elements and main group metals. Topics include a survey of ligands and coordination chemistry/geometry of transition metals and main group metals. The properties and reactions of organometallic complexes, and applications of organotransition metal compounds in catalysis, organic synthesis, bioinorganic chemistry and medicinal chemistry are reviewed.
Prerequisites: Minimum grades of C- in CHEM 232 and CHEM 263.

CHEM 342
Materials Chemistry
3 Credits Weekly (3-3-0)
This course is about the relationships among processing, structure, properties, performance, applications and sustainability of materials. It covers the materials classed as metal alloys, crystals, glasses, ceramics, plastics and composites. It examines the structural assembling of materials at the macroscopic, microscopic, nanoscopic and atomistic scales of size. The interatomic and intermolecular bonding at play in the assembling of such structures is analyzed. How mechanical, optical, electrical, surface, bonding and catalytic properties arise from the structural assemblage is discussed. Emphasis is placed on the methods of processing chemical substances to manufacture materials with desired structure and properties, as well as on integration of materials in technological devices.
Prerequisites: A minimum grade of C- in CHEM 242, or in CHEM 102 and PHYS 208, or in CHEM 102, MATH 114, and PHYS 224.

CHEM 353
Forensic Chemistry
3 Credits Weekly (3-3-0)
This course examines the theory and practice of forensic chemistry. The course focuses on chemical analytical techniques used for the detection, identification, and comparison of forensic evidence such as illicit drugs, poisons, gunshot residues, fire accelerants, and explosives. The theory of a variety of analytical techniques along with their scope and limitations is embedded in this discussion. The practical application of these techniques is considered with reference to appropriate examples and forensic case studies. This is further reinforced in the laboratory, where students will gain hands-on experience in the use of a range of analytical techniques for the investigation of simulated crime scenarios. The structure and function of forensic chemistry laboratory services and the key issues of cross-contamination and laboratory quality control and quality assurance will be examined.
Prerequisites: A minimum grade of C- in CHEM 261 and either CHEM 211 or CHEM 252.

CHEM 362
Advanced Organic Chemistry
3 Credits Weekly (3-3-0)
This course is designed to build upon the concepts introduced in Chemistry 261 and Chemistry 263, offering a more advanced and sophisticated insight into the physical properties and chemical reactions of organic compounds. A focal point will be the chemistry of carbonyl compounds. Mechanistic understanding of reaction pathways and multistep synthesis of more complex compounds will be emphasized.
Prerequisites: Minimum grade of C- in CHEM 263.

CHEM 364
Introduction to Medicinal Chemistry
3 Credits Weekly (3-0-0)
Students will be introduced to pharmaceutical drug discovery and the pivotal role played by chemistry. The principles and processes involved in modern drug design and development are presented and, throughout, are emphasized by reference to compounds in current clinical usage. Particular emphasis is placed on cancer therapeutics and antiviral agents. Recent advances in the use of computational and combinatorial chemistry in drug design are discussed.
Prerequisites: Minimum grade of C- in CHEM 263.

CHEM 372
Environmental Chemistry
3 Credits Weekly (3-3-0)
The chemistry of natural environmental process and the impact of anthropogenic activity on those processes will be examined. Topics include atmospheric chemistry, including photochemical reactions, ozone depletion and urban air pollution; aquatic chemistry, including complex equilibria, buffering, and oxidation and reduction; and an introduction to sources and fate of organic and inorganic pollutants. In the laboratory, students will gain hands on experience in common methods of environmental testing and remediation. Note: Credit cannot be received for both CHEM 270 and CHEM 372.
Prerequisites: A minimum grade of C- in CHEM 102 and CHEM 261.

CHEM 380
Process and Flow Chemistry
3 Credits Weekly (3-3-0)
This course provides an introduction and training in the different types of chemical and physical methods, and equipment that may be employed in process and flow chemistry. The use and installation of process analytical technology/chemistry is also explored. On-line and in-line monitoring of chemical processes is strongly emphasized, both in the lecture and the laboratory environment.
Prerequisites: A minimum grade of C– in CHEM 211 or CHEM 263.

CHEM 391
Applied Spectroscopy
3 Credits Weekly (3-2-0)
This course focuses on the practical aspects of preparing samples for analysis, collecting and analyzing data, and characterizing organic, inorganic and/or biological compounds. Methods are explored from a theoretical and practical perspective and include infrared spectroscopy, mass spectrometry, and nuclear magnetic resonance. Note: Credit cannot be obtained for both CHEM 291 and CHEM 391.
Prerequisites: A minimum grade of C- in CHEM 263.

CHEM 398
Independent Study
3 Credits Total (0-0-72)
This course permits an intermediate-level student to work with a faculty member to explore a specific topic in depth through research or through directed reading in primary and secondary sources. The student plans, executes and reports the results of their 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: Any 200-level chemistry course and permission of the department, Faculty mentors may require additional prerequisites according to the project needs.

CHEM 410
Industrial Chemistry
3 Credits Weekly (3-0-0)
An introduction to the principles and practice of industrial chemistry with a special emphasis on modern and emerging chemical technology processes. Selected industrial processes will be discussed, such as the production of primary petrochemicals and their associated secondary products, including polymers, pharmaceuticals, dyes, perfumes, and pesticides. Students will be introduced to the production of such products based on emerging principles of sustainable industrial chemistry. The focus will be on chemical plant design processes, chemo/biocatalysis, biowaste valorization, and pollution control. Principles of green and environmental chemistry and how they impact the United Nations Sustainable Development Goals (UN SDGs) will be emphasized. Students will also learn professional ethics as they relate to chemistry practice. This course includes presentations by guest industrial chemists and tours of chemical plants and industrial laboratories.
Prerequisites: A minimum grade of C- in any 300-level CHEM *(*https://calendar.macewan.ca/course-descriptions/chem/*) course.*

CHEM 441
Molecular Modelling
3 Credits Weekly (3-3-0)
This introduction to molecular modelling deals with the application of quantum mechanical methods to compute structural models, molecular and bulk properties of matter, and the mechanisms by which molecules interact and react. Students use up-to-date software to build, render and visualize molecular structures generated with wave function and density functional methods; to compute molecular properties and spectra of substances; to design reaction mechanisms of uncatalyzed and catalyzed reactions, and to compute their associated rate constants. Students devise structural and computational models for acid-base, redox, enzyme and surface reactions relevant to life, environment and technology.
Prerequisites: A minimum grade of C- in CHEM 342.

CHEM 442
Soft Matter Chemistry
3 Credits Weekly (3-3-0)
This course is about the spontaneous formation, preparation, properties, stability, and applications of soft matter. It focuses on the complex and easily deformable structures that emerge in between atomic and macroscopic length scales in solutions of polymers and surfactants, colloids, liquid crystals, granular and soft biological matter. It examines the physical mechanisms of structural assembling and self-organization of molecules to form thin films, micelles, lipid bilayers, vesicles and liposomes under the action of intermolecular and surface forces. Topics include surfaces, charged interfaces, effects of surface tension and curvature on capillarity and wetting, optical, electrokinetic, flow and rheological properties. Emphasis is placed on the applications of soft matter phenomena in petroleum, pharmaceutical, cosmetics and food technologies and products.
Prerequisites: A minimum grade of C- in CHEM 342.

CHEM 464
Advanced Synthetic Medicinal Chemistry
3 Credits Weekly (3-1.5-0)
This advanced medicinal chemistry course examines the application of organic chemistry in the design and synthesis of small-molecule drugs. Students will utilize the principles of the drug discovery process to identify targets for pharmaceutical development and gain an in-depth understanding on how to chemically modify a drug through each stage of the development process. Emphasis will be placed on examining the structure-activity relationship between molecules and their targets, drug delivery, drug modes of action, and the fate of drugs once inside the body.
Prerequisites: A minimum grade of B- in either CHEM 364 or CHEM 362.

CHEM 466
Modern Catalysis
3 Credits Weekly (3-0-0)
This course provides a comprehensive review of current research and practice in the field of modern catalysis. The topics covered include, catalytic design, catalysis and energy, chemical transformations, biocatalysts, and environmental catalysts. The mechanisms by which enzymes operate in living matter and the use of both organic and inorganic catalysts by the chemical industry for the production of bulk chemicals, fine chemicals and fuels will be covered.
Prerequisites: A minimum grade of C- in CHEM 333.

CHEM 472
Advanced Environmental Chemistry
3 Credits Weekly (3-2-0)
This course presents an advanced study of anthropogenic pollutants in the environment. Fate and transport processes of legacy and emerging anthropogenic pollutants, including important physio-chemical processes, such as partitioning, hydrolysis, photolysis and biotransformation, are discussed on both a local and global scale. Understanding of these processes is applied in the context of environmental modeling. In the laboratory, students gain hands on experience with the techniques used to determine the environmental fates of pollutants via investigations of their physio-chemical properties. Credit cannot be received for both CHEM 370 and CHEM 472.
Prerequisites: A minimum grade of C– in CHEM 261 and in either CHEM 270 or CHEM 372.

CHEM 474
Environmental Analytical Chemistry
3 Credits Weekly (3-3-0)
Students will learn the theory and develop practical skills in the quantitative and qualitative analysis of chemicals in the environment. Proper procedures for environmental sampling design will be discussed, followed by a detailed treatment of environmental sampling, extraction, and cleanup techniques. The theory and application of modern analytical techniques will be discussed in the context of environmental monitoring. In the laboratory, students will design and carry out field-based measurements and apply lecture material in a practical setting.
Prerequisites: A minimum grade of B- in CHEM 311, and in one of CHEM 270 or CHEM 372.

CHEM 484
Sustainable and Green Chemistry
3 Credits Weekly (3-0-0)
This course introduces Green Chemistry and examines industrial sources of contaminants and the modification of industrial processes to minimize environmental impact. In addition, the course reviews industrial waste management, control, and treatment. Students will gain an understanding of modern green chemistry which considers both the application and use of the 12 principles of green chemistry and life cycle analysis. In this regard, both the advantages and limitations of the various green chemistry approaches will be examined.
Prerequisites: A minimum grade of C- in any 300-level CHEM *(*https://calendar.macewan.ca/course-descriptions/chem/*) course and permission of the department.*

CHEM 495
Special Topics
3 Credits Weekly (0-0-3)
This course involves reading, discussing and critically evaluating current research on specialized topics in chemistry. Topics covered vary with the interests of students and faculty. Students should consult with faculty members in the Department of Physical Sciences for details regarding current offerings. Note: This course is intended for students in the final year of their degree. This course may be taken up to two times for credit.
Prerequisites: A minimum grade of B- in a 300-level CHEM *(*https://calendar.macewan.ca/course-descriptions/chem/*) course and permission of the department.*

CHEM 496
Techniques in Applied Laboratory Chemistry
3 Credits Weekly (0-6-0)
This is a laboratory-based course focusing on techniques utilized in a research or industrial laboratory setting. Students will gain an understanding of the theory and application of modern experimental methods and build practical skills through project-based applications. The specific topics covered will vary with the interests of the faculty member teaching the course, and students should consult with the Department of Physical Sciences for details regarding current offerings. Note: This course may be taken up to two times, provided the topic of the course is different.
Prerequisites: A minimum grade of B- in a 300-level chemistry course and consent of the department.

CHEM 497
Chemistry Internship Practicum
3 Credits Total (45-0-90)
This course provides students with practical experience in a chemistry related work environment. Students engage in work integrated learning through employment or internship at a chemistry-related industry. Students learn in practice the professional aspects (work and ethics) of a chemist. 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 6 credits of any 300 level CHEM *(*https://calendar.macewan.ca/course-descriptions/chem/*) courses and consent of the Department.*

CHEM 498
Advanced Independent Study
3 Credits Total (0-0-72)
This course permits a senior-level student to work with a faculty member to explore a specific topic in depth through research or through directed reading in primary and secondary sources. The student plans, executes and reports the results of their 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: A minimum grade of B- in a 300-level CHEM *(*https://calendar.macewan.ca/course-descriptions/chem/*) course, a minimum grade of C- in SCIE 201, and permission of the department; faculty mentors may require additional prerequisites according to the project needs.*