



# Chemical Technology Diploma

## PLAR Candidate Guide

Prior Learning Assessment and Recognition (PLAR)

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### Prior learning credit options at Saskatchewan Polytechnic

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See [Get Credit for What you Know](#) for important information about all options to get credit for prior learning at Sask Polytech, including PLAR, transfer credit, Canadian Armed Forces credit, and equivalency credit.

### How to navigate this document

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This document contains links to other document sections or webpages. To return to where you were from another section in this document, press the *ALT* key and *left arrow* key at the same time. To return to this webpage from another webpage, close the other webpage or click back on the browser tab for this document.

### Contents of this guide

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This guide contains the following specific PLAR information and tools for this program

- A. [PLAR fees](#)
- B. [PLAR eligibility and options](#)
- C. [Dates when PLAR assessment is available](#)
- D. [Special directions for this program](#)
- E. [PLAR contact person](#)
- F. [Self-rating course outlines](#)

## A. PLAR fees

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Fees for PLAR challenges are set to cover our costs for consultation, assessment, and related administrative tasks. PLAR fees are non-refundable and non-transferrable.

The PLAR fees policy is subject to change for each new academic year. Please see the **Cost** section on the [PLAR webpage](#) for current fee information.

## B. PLAR eligibility and options

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To be eligible for PLAR for courses in this program, you must first apply for admission and be accepted into the program. You must also consult with the [PLAR contact person](#) and be approved for PLAR assessment.

### Course prerequisites and corequisites

Some courses have one or more other courses that must be completed first (prerequisite) or at the same time (corequisite). See [course outlines](#) in this guide to identify any pre- or co-requisites for each course. Discuss with your [PLAR contact person](#) how to deal with courses with corequisites.

### Block assessment

Some programs may assess a cluster of courses together in one block, which may save you time and effort. Ask the [PLAR contact person](#) whether there are any block assessment options in this program.

## C. Dates when PLAR assessment is available

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PLAR assessment for this program is available from Sept 1 to June 15 in each academic year.

**All PLAR assessments must be completed by June 15 of each academic year.**

## D. Special directions for this program

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1. **Review** the [PLAR process and FAQs](#) and the information in this guide.
2. **Self-rate** your learning for each course using the [Course Outlines](#) in this guide.
3. **Consult** with the [PLAR contact person](#) for PLAR approval. Be prepared to provide your resume, course self-ratings (see [section F](#)), and a partially completed [PLAR application](#). If you are approved for PLAR, the contact person will sign your PLAR application and explain next steps.
4. Apply for admission to the program. See [directions](#) for applying.
5. **Register** for PLAR at [Registration/Enrolment Services](#) once you have signed approval on your [PLAR Application Form](#). The PLAR fee will be added to your student account.
6. **Finalize** an assessment plan with your assigned assessor.
7. **Complete** assessment before your PLAR registration expires.

## E. PLAR contact person

Contact one of the Program Heads below to arrange a consultation **after** you have read this guide and [general PLAR information](#) and rated yourself for each course (see next section). Consultation may be by phone, online, or in person. Be prepared to provide your resume, course self-ratings, and a partially completed [PLAR application](#). If agreement is reached to go ahead with PLAR, the contact person will sign approval on your PLAR application and explain the next steps. Admission to the program is required before you can register for PLAR.

**Amy Douglas, Program Head**  
Saskatchewan Polytechnic, Saskatoon Campus  
Phone: 306 – 659 - 4382  
Email: [douglas2382@saskpolytech.ca](mailto:douglas2382@saskpolytech.ca)

## F. Self-rating course outlines

Clicking on a course code below opens a page where you can rate yourself on the knowledge and skills assessed for PLAR credit. For Arts & Sciences courses, clicking on the course code opens another PLAR guide. The [PLAR contact person](#) for this program will refer you to another person to discuss PLAR for courses delivered by Arts & Sciences or another program/department.

COURSE CODE	COURSE NAME	Delivered by another department/program
<b>Semester 1</b>		
<a href="#">CHEM 150</a>	Organic Chemistry 1	
<a href="#">CHEM 151</a>	Organic Chemistry 1 Lab	
<a href="#">CHEM 178</a>	General Chemistry 1	
<a href="#">COMP 174</a>	Introduction to Microsoft Excel 1	<a href="#">CST</a>
<a href="#">LABT 150</a>	Analytical Instrumentation 1	
<a href="#">LABT 151</a>	Analytical Instrumentation 1 Lab	
<a href="#">MATH 189</a>	Mathematics 1	<a href="#">Arts &amp; Sciences</a>
<a href="#">MATH 192</a>	Laboratory Mathematics	
<a href="#">SFTY 185</a>	Laboratory Safety	
<a href="#">STAT 101</a>	Introductory Statistics and Computer Applications	<a href="#">Arts &amp; Sciences</a>
<b>Semester 2</b>		
<a href="#">CHEM 152</a>	Organic Chemistry 2	

COURSE CODE	COURSE NAME	Delivered by another department/program
<a href="#">CHEM 153</a>	Organic Chemistry 2 Lab	
<a href="#">CHEM 179</a>	General Chemistry 2	
<a href="#">CHEM 295</a>	Plant and Process Chemistry	
<a href="#">LABT 152</a>	Analytical Instrumentation 2	
<a href="#">LABT 153</a>	Analytical Instrumentation 2 Lab	
<a href="#">MATH 289</a>	Mathematics 2	<a href="#">Arts &amp; Sciences</a>
<a href="#">PHYS 106</a>	Physics	<a href="#">Arts &amp; Sciences</a>
<b>Semester 3</b>		
<a href="#">CHEM 282</a>	Nuclear Chemistry	
<a href="#">CLTR 119</a>	Indigenous Cultural Awareness	
<a href="#">LABT 154</a>	Sampling Techniques	
<a href="#">SAFE 119</a>	Applied Laboratory Safety	
<a href="#">STAT 281</a>	Statistics and Computer Applications	<a href="#">Arts &amp; Sciences</a>
<b>Semester 4</b>		
<a href="#">CHEM 250</a>	Analytical Chemistry	
<a href="#">CHEM 251</a>	Analytical Chemistry Lab	
<a href="#">CHEM 292</a>	Physical Chemistry 1	
<a href="#">LABT 250</a>	Analytical Instrumentation 3	
<a href="#">LABT 251</a>	Analytical Instrumentation 3 Lab	
<a href="#">LABT 297</a>	Laboratory Preparation Techniques in Chemistry	
<a href="#">QC 250</a>	Quality control in Laboratories	
<a href="#">QC 251</a>	Quality Control in Laboratories Project	
<a href="#">TCOM 102</a>	Workplace Communication	<a href="#">Arts &amp; Sciences</a>
<b>Semester 5</b>		

COURSE CODE	COURSE NAME	Delivered by another department/program
<a href="#">CHEM 293</a>	Physical Chemistry 2	
<a href="#">CHEM 296</a>	Water Chemistry	
<a href="#">COMM 289</a>	Communication 2	<a href="#">Arts &amp; Sciences</a>
<a href="#">ENVR 290</a>	Environmental Monitoring	
<a href="#">LABT 252</a>	Analytical Instrumentation 4 Lab	
LABT 253	Analytical Instrumentation 4 Lab	
<a href="#">PROJ 290</a>	Applied Research 2	
<a href="#">WORK 203</a>	Practicum	

## CHEM 150 - Organic Chemistry 1

You will be introduced to the chemistry of organic compounds. You will begin by reviewing the concepts of chemical bonding. You will use these concepts to examine structure and bonding in typical classes of organic compounds. The names, physical properties and uses of the common functional groups will be introduced. You will examine the chemistry of organic compounds in terms of the preparation of typical functional groups, and the mechanisms of simple reactions.

**Credit unit(s):** 2.0  
**Prerequisites:** none  
**Corequisites:** CHEM 151, CHEM 178  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
Review covalent bonding, Lewis structures, resonance structures, and the shape of molecules.			
Compare the chemical structures of common organic functional groups including alkanes, alkenes, alkynes, alkyl halides, alcohols, ethers, thiols, amines, and benzene.			
Choose the appropriate common or IUPAC chemical name for molecules containing common organic functional groups.			
Discriminate between chiral and achiral molecules.			
Relate the chemical and physical properties of common organic functional groups to their reactivity.			
Examine the mechanisms of chemical reactions including electrophilic addition, nucleophilic substitution and elimination, and electrophilic aromatic substitution reactions.			

## CHEM 151 - Organic Chemistry 1 Lab

You will be introduced to the safe handling and use of organic chemicals in a laboratory. This will include the proper use of chemical fume hoods and personal protective equipment. You will identify chemical properties of common organic functional groups (alkanes, alkenes, alkynes, alkyl halides, alcohols, ethers, and amines), and test the chemical reactivity of these substances. The concept of stereochemistry and chirality in organic molecules will also be explored using molecular models. Single step synthetic protocols will be followed, and common synthetic organic techniques will be explored. These techniques will include liquid-liquid extraction, separations based on distillation, filtration, and chromatography, as well as simple characterization of organic molecules by melting point determination, IR spectroscopy, and chromatographic techniques.

**Credit unit(s):** 3.0  
**Prerequisites:** none  
**Corequisites:** CHEM 150  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Manipulate organic chemicals safely by using appropriate equipment and procedures.			
2. Describe the chirality and stereochemistry of organic molecules.			
3. Complete a liquid-liquid extraction.			
4. Perform a separation using the simple distillation technique.			
5. Perform a separation using chromatography.			
6. Execute a single-step synthetic procedure to produce an organic molecule.			
7. Compare the chemical reactivity of various organic molecules.			
8. Distinguish organic molecules based on common characterization techniques.			

## CHEM 178 - General Chemistry 1

You will receive an overview of the fundamental chemical theory and properties of the elements and their compounds. The laboratory experiments are designed to help you examine the practical aspects of chemical theory. You will also receive an introduction to laboratory techniques.

**Credit unit(s):** 4.0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Review basic concepts regarding significance of measurements, using scientific numbers, and performing dimensional analysis.			
2. Describe matter at the macroscopic and microscopic level.			
3. Determine the appropriate chemical name and formula of ionic and molecular compounds.			
4. Solve stoichiometry problems for chemical reactions using the mole concept.			
5. Examine chemical reactions (precipitation, acid-base neutralization, and oxidation-reduction) that occur in aqueous solutions.			
6. Determine the electron configuration of an atom using quantum theory and the building-up principle.			
7. Examine the relationship between the electron configuration of elements and their chemical and physical properties.			
8. Determine the types and number of chemical bonds formed by atoms in molecules and compounds based on the electron configuration of the elements.			



### COMP 174 - Introduction to Microsoft Excel 1

You will study the basic features of Excel. You will learn to create workbooks, format spreadsheet elements, manipulate multiple worksheets, create simple charts, and use simple formulas and functions.

**Credit unit(s):** 1.0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Create a spreadsheet.			
2. Use basic functions and productivity tools.			
3. Work with multiple worksheets.			
4. Create basic charts.			

## LABT 150 - Analytical Instrumentation 1

You will begin your studies on analytical instrumentation by learning about components and terminology common to most instruments. Your first introduction to the functioning of instrumentation will include pH meters, ion selective electrodes, and basic spectrometers. You will learn about measures of quality in measurements and calibration of instrumentation.

**Credit unit(s):** 2.0  
**Prerequisites:** none  
**Corequisites:** LABT 151, MATH 192  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Describe the functionality of components in analytical instrumentation.			
2. Use statistical terminology relevant to analytical instrumentation.			
3. Describe factors which influence signal and noise in instrumentation.			
4. Choose samples, blanks, and standards for different types of calibration.			
5. Analyze quality of calibration and the limits to linearity.			
6. Describe applications and limitations of Beer's law in spectroscopy.			

### LABT 151 - Analytical Instrumentation 1 Lab

You will be introduced to the operation of instrumentation for chemical analysis. You will learn about calibration of instrumentation for quantitative measurements using physical measurements of natural phenomena. You will be provided instruction in the operating techniques of pH meters and basic spectrophotometers.

**Credit unit(s):** 3.0  
**Prerequisites:** none  
**Corequisites:** LABT 150, MATH 192  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Apply graphical and computer software tools to create calibration curves for instrumental analyses.			
2. Make samples and standards using appropriate wet chemistry techniques.			
3. Perform potentiometric measurements.			
4. Examine chemical interference and environmental effects on experimental results.			
5. Characterize linearity in the calibration of instrumentation.			
6. Examine the quality of signal to noise in data acquisition.			
7. Perform visible spectroscopic analyses.			

## MATH 189 - Mathematics 1

You will review the fundamental concepts of algebra and trigonometry. Your studies will focus on equations of various types, graphing, systems of linear equations, variation, properties of exponents and logarithms, logarithmic and exponential equations, and trigonometry. Whenever possible, problem solving will be directly related to chemistry applications. You will also receive an introduction to calculus.

**Credit unit(s):** 4.0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Use algebra.			
2. Solve linear and quadratic equations.			
3. Solve systems of equations.			
4. Use logarithms.			
5. Use ratio and proportion.			
6. Use trigonometry to solve problems in applied sciences.			
7. Calculate derivatives.			

## MATH 192 - Laboratory Mathematics

You will develop the mathematical skills needed to work in a research or diagnostic laboratory. Your studies will focus on the various types of solution calculations and different units of measurement.

**Credit unit(s):** 2.0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Apply the rules for rounding and significant figures.			
2. Use The International System of Units (SI).			
3. Identify common concentration units used in chemical laboratories.			
4. Perform calculations to determine the concentration of solutions.			
5. Perform acid/base calculations.			

### SFTY 185 - Laboratory Safety

You will discuss topics related to safe working practices and procedures in the chemical laboratory. Many of these topics are related to government regulations and industrial laboratory guidelines.

**Credit unit(s):** 1.0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Interpret Canadian regulations governing the use of hazardous materials in a laboratory setting.			
2. Examine safety equipment used in chemical laboratories and the chemical industry.			
3. Examine the safe handling, storage and disposal of hazardous chemicals.			

## STAT 101 - Introductory Statistics and Computer Applications

You will be introduced to basic statistical methods and the use of computers to solve statistical and related problems. You will learn about statistical topics related to central limit theorem and associated distribution functions, confidence intervals, regression and correlation analysis. You will learn the use of calculators, and spreadsheets to calculate statistical values.

**Credit unit(s):** 3.0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<p><b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b></p> <p><b>Competent:</b> I can apply this outcome without direction or supervision.  <b>Learning:</b> I am still learning skills and knowledge to apply this outcome.  <b>None:</b> I have no knowledge or experience related to this outcome.</p>	Competent	Learning	None
4. Apply the principles of introductory statistics in a scientific environment.			
5. Apply basic statistics and central limit theorem.			
6. Calculate confidence intervals for means.			
7. Apply normal and t distributions to problems.			
8. Interpret correlation using a linear regression technique.			
9. Use a calculator to perform one variable and two variable statistical calculations.			
10. Use Excel to perform one variable statistical calculations.			
11. Use Excel to perform two variable statistical calculations.			
12. Prepare a graphical representation of data using Excel.			

## CHEM 152 - Organic Chemistry 2

You will be introduced to the nomenclature and structure of common functional groups (aldehydes, ketones, carboxylic acids, acid chlorides, anhydrides, esters, amides, carbohydrates, and common linkages in polymers) in organic molecules. The chemical properties and reactivities of these organic functional groups will also be explored. You will discuss methods to characterize organic molecules (including the use of infrared, and nuclear magnetic resonance techniques). You will study the properties, structures, reactions and industrial uses of several important classes of compounds.

**Credit unit(s):** 2.0  
**Prerequisites:** CHEM 150, CHEM 151  
**Corequisites:** none  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome		Competent	Learning	None
Competent:	I can apply this outcome without direction or supervision.			
Learning:	I am still learning skills and knowledge to apply this outcome.			
None:	I have no knowledge or experience related to this outcome.			
1.	Compare the chemical structures of organic functional groups including amines, aldehydes, ketones, carboxylic acids, acid chlorides, anhydrides, esters, and amides.			
2.	Choose the appropriate name for molecules containing organic functional groups.			
3.	Relate the chemical and physical properties of organic functional groups to their reactivity.			
4.	Examine the mechanisms of a number of chemical reactions including the Grignard reaction, formation of an acetal, keto-enol tautomerization, and esterification reactions.			
5.	Discuss the basic principles of molecular spectroscopy.			
6.	Interpret basic infrared (IR) and nuclear magnetic resonance (NMR) spectra.			



## CHEM 153 - Organic Chemistry 2 Lab

You will use common synthetic organic techniques to explore the properties and reactivity of common organic molecules (aldehydes, ketones, carboxylic acids, acid chlorides, anhydrides, esters, amides, carbohydrates, and polymers), and to carry out a multi-step synthetic protocol. You will also learn how to prepare and analyze samples by infrared (IR) spectroscopy and nuclear magnetic resonance spectroscopy (NMR).

**Credit unit(s):** 3.0  
**Prerequisites:** CHEM 150, CHEM 151  
**Corequisites:** none  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome		Competent	Learning	None
Competent:	I can apply this outcome without direction or supervision.			
Learning:	I am still learning skills and knowledge to apply this outcome.			
None:	I have no knowledge or experience related to this outcome.			
1.	Compare the chemical reactivity of various organic molecules.			
2.	Execute a multi-step synthetic procedure to produce an organic molecule.			
3.	Perform a recrystallization on a reaction product.			
4.	Demonstrate the use of an infrared (IR) spectrometer for the characterization of organic molecules.			
5.	Determine the chemical structure of an organic molecule from data obtained from IR and NMR spectrometers.			

## CHEM 179 - General Chemistry 2

You will study chemical theory and properties of aqueous solutions. Your studies will focus on chemical reactions, chemical equilibrium, stoichiometry reactions and the solubility of compounds.

**Credit unit(s):** 4.0  
**Prerequisites:** CHEM 178, MATH 192  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Relate the energy of a chemical reaction to thermodynamic principles.			
2. Determine the effect of temperature and reactant concentration on the rate of a chemical reaction.			
3. Characterize the physical properties of a solution.			
4. Predict the equilibrium concentration of a product of a reversible chemical reaction.			
5. Classify the acidic/basic properties of solutions based on composition and concentration.			
6. Apply Le Chatelier's principle to acid-base equilibria, buffer theory and solubility.			
7. Solve for the concentration of components in a mixture during titration reactions.			

## CHEM 295 - Plant and Process Chemistry

You will receive a general overview of the main aspects involved with chemical process industries. You will study the industrial and chemical processes used to convert raw material into a variety of products specific to Saskatchewan industries. Tours to various industrial sites will accompany some of the topics you will cover.

**Credit unit(s):** 3.0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Describe the various mining and refining processes in Saskatchewan.			
2. Discuss the refining process of crude oils.			
3. Describe batch reactions for large scale chemical production.			
4. Examine chemical production from agricultural sources.			

## LABT 152 - Analytical Instrumentation 2

You will be introduced to both physical and chemical separation methods. You will learn the basic theory behind chromatographic separations. Your studies will focus on instrumentation, column theory and the application of these techniques to various separation problems in gas and liquid chromatography.

**Credit unit(s):** 2.0  
**Prerequisites:** LABT 150, LABT 151  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Explain separations based on chemical and physical properties.			
2. Explain common terminology used in chromatographic separations.			
3. Describe the instrumental factors that affect the retention time and resolution of a chromatogram.			
4. Examine the instrument components and factors affecting separations performed on gas chromatographs.			
5. Examine the instrument components and factors affecting separations performed on liquid chromatographs.			
6. Discuss a variety of liquid chromatography techniques including ion chromatography and size-exclusion chromatography.			

### LABT 153 - Analytical Instrumentation 2 Lab

You will be instructed on how to operate both gas chromatographs and liquid chromatographs in the laboratory. You will develop methods to separate mixtures using the chromatographic instruments, and to adjust instrumental parameters to improve the efficiency and the resolution of the separations.

**Credit unit(s):** 3.0  
**Prerequisites:** LABT 150, LABT 151  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Perform an isothermal separation using a gas chromatograph.			
2. Develop a method that uses a thermal gradient to separate a mixture on a gas chromatograph.			
3. Apply methods for quantitative analysis.			
4. Perform separations using a liquid chromatograph.			
5. Develop a method that uses a mobile phase gradient to separate a mixture on a liquid chromatograph.			

## MATH 289 - Mathematics 2

You will focus on differential and integral calculus. You will learn differentiation of algebraic and transcendental functions, and applications of the derivative. You will study numerous methods of integration and selected applications of integration. Your studies will also include an introduction to partial derivatives.

**Credit unit(s):** 4.0  
**Prerequisites:** MATH 189  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Calculate derivatives of transcendental functions.			
2. Solve problems requiring the application of derivatives.			
3. Derive integrals of algebraic functions.			
4. Calculate partial derivatives.			
5. Apply indefinite integration.			
6. Apply definite integration.			
7. Use advanced methods of integration.			

**PHYS 106 - Physics**

You will be provided with an introduction to physics. Your studies will provide an overview of force electricity, magnetism, and optics. You will gain understanding of mechanical processes and energy exchange. You will also study basic circuitry. In the laboratory experiments you will use problem solving as an integral part of the course. You will receive an overview of the behaviour of light, geometrical optics, and wave optics. In the laboratory, you will explore each of these topics to illustrate the theory.

**Credit unit(s):** 4.0  
**Prerequisites:** MATH 189  
**Corequisites:** none  
**Equivalent course(s):** none

<p><b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b></p> <p><b>Competent:</b> I can apply this outcome without direction or supervision.  <b>Learning:</b> I am still learning skills and knowledge to apply this outcome.  <b>None:</b> I have no knowledge or experience related to this outcome.</p>	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Describe Newton’s principles of motion.			
2. Solve problems involving classical mechanics and mechanical energy transfer.			
3. Explain processes which result in energy transfer and energy loss in mechanical processes.			
4. Analyze momentum and inertia in collisions.			
5. Solve problems on basic circuitry involving resistors, capacitors, and power sources.			
6. Analyze Ohm’s law and response time in basic circuitry.			
7. Describe the electrical protection and safety devices in instrumentation.			
8. Examine the relationship between electricity, magnetism, and effects on charged particles.			
9. Examine magnetic field and magnetic effect of current.			
10. Characterize the functioning of basic optical components.			
11. Characterize the properties of light based on wave optics and interference.			
12. Examine diffraction, refraction, and interference effects of optical components.			

## CHEM 282 - Nuclear Chemistry

You will be introduced to the fundamental concepts of nuclear chemistry. Your studies will include: radioactivity, rates of decay, nuclear reactions, radioactive isotopes, radiation measurement, radiation units and safety, the biological effects of radiation, and the use of radiation detection devices in the laboratory.

**Credit unit(s):** 2.0  
**Prerequisites:** CHEM 178, MATH 189  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Describe structure and stability of the atomic nucleus.			
2. Summarize radioactivity and nuclear energy.			
3. Describe different radiation units.			
4. Describe nuclear safety regulations and their implementation in the workplace.			
5. Demonstrate the use of radiation detection and detector devices.			
6. Describe various sources of ionizing radiation and particle generators.			



**CLTR 119 – Indigenous Cultural Awareness**

**Credit unit(s):** .0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<p><b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b></p> <p><b>Competent:</b> I can apply this outcome without direction or supervision.  <b>Learning:</b> I am still learning skills and knowledge to apply this outcome.  <b>None:</b> I have no knowledge or experience related to this outcome.</p>	Competent	Learning	None
1.			

## LABT 154 - Sampling Techniques

You will receive the theoretical and practical background needed to understand the steps required to obtain a representative sample for chemical analysis on water, air and soil samples. You will understand the principles of sampling techniques and the importance of having a sampling plan.

**Credit unit(s):** 2.0  
**Prerequisites:** STAT 101  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Identify the principles of sampling techniques and the importance of having a sampling plan.			
2. Discuss the principles of sampling soil, ore and bulk solid material.			
3. Discuss the principles of sampling air and gases.			
4. Discuss the principles of sampling industrial slurry, surface water and ground water.			
5. Demonstrate the ability to operate various water sampling equipment.			
6. Perform basic sampling techniques to achieve representative sampling.			

## SAFE 119 – Applied Laboratory Safety

**Credit unit(s):** .0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1.			

## STAT 281 - Statistics and Computer Applications

You will be introduced to hypothesis testing, analysis of variance, experimental design, non-parametric tests, and the application of spreadsheets to statistical analysis.

**Credit unit(s):** 4.0  
**Prerequisites:** STAT 101  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Examine probability and independence of statistical data.			
2. Apply the calculation and interpretation of Z scores to the solution of chemical technology problems.			
3. Apply the F distribution and the chi-square distribution to problems in chemical technology.			
4. Calculate the confidence interval for variance.			

Use a checkmark (✓) to rate yourself as follows for each learning outcome	Competent	Learning	None
<b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.			
5. Apply hypothesis testing to problem solving in technology areas.			
6. Apply the concepts and techniques of quality control.			
7. Use the techniques of experimental design.			
8. Use Excel for application of advanced statistical analysis.			
9. Apply non-parametric methods to the general science areas.			

### CHEM 250 - Analytical Chemistry

You will be introduced to the basic methods and chemistry of manual analytical techniques coupled with a description of selected methods in sampling, separation, and data treatment. In your focus on wet chemistry processes, you will solve problems involving acid-base, neutralization, precipitation, solubility equilibrium, complex formation, and oxidation-reduction titrations.

**Credit unit(s):** 3.0  
**Prerequisites:** CHEM 179, MATH 192, STAT 101, LABT 150  
**Corequisites:** CHEM 251  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome	Competent	Learning	None
<b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.			
1. Assess data and methods using routine statistical tests.			

<p><b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b></p> <p><b>Competent:</b> I can apply this outcome without direction or supervision.  <b>Learning:</b> I am still learning skills and knowledge to apply this outcome.  <b>None:</b> I have no knowledge or experience related to this outcome.</p>	Competent	Learning	None
2. Assess uncertainty in data using propagation of errors.			
3. Solve problems involving acid-base equilibria.			
4. Solve problems involving acid-base titrations.			
5. Solve problems involving solubility equilibrium and precipitation titrations.			
6. Solve problems involving buffer preparation.			
7. Solve problems involving gravimetric analyses.			
8. Solve problems involving complex formation.			
9. Solve problems involving redox reactions and redox titrations.			

## CHEM 251 - Analytical Chemistry Lab

You will be introduced to the basic laboratory methods of manual analytical techniques coupled with data treatment. The use of precision laboratory equipment and achieving precision and accuracy in scientific measurements will be emphasized in your laboratory work. You will perform acid-base, neutralization, precipitation, complex formation, and oxidation-reduction titrations. You will perform gravimetric analysis and prepare buffers.

**Credit unit(s):** 3.0  
**Prerequisites:** CHEM 179, MATH 192, STAT 101, LABT 150  
**Corequisites:** CHEM 250  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome		Competent	Learning	None
Competent:	I can apply this outcome without direction or supervision.			
Learning:	I am still learning skills and knowledge to apply this outcome.			
None:	I have no knowledge or experience related to this outcome.			
1.	Apply routine statistical tests to assess the quality of data acquired in the laboratory.			
2.	Calibrate volumetric laboratory equipment.			
3.	Perform neutralization titrations.			
4.	Perform precipitation titrations.			
5.	Perform gravimetric analyses.			
6.	Perform complex formation titrations.			
7.	Perform oxidation-reduction titrations.			
8.	Select chemical(s) and indicator(s) for titrations and buffer preparation.			

## CHEM 292 - Physical Chemistry 1

You will learn the basic principles, laws, and theories of thermodynamics and thermochemistry. You will develop the ability to derive equations that describe the phenomena being studied, and to solve quantitative problems. Your practical experiments in the laboratory will provide the opportunity to investigate different aspects of some of these driving principles.

**Credit unit(s):** 4.0  
**Prerequisites:** CHEM 179, MATH 289, STAT 101  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Describe the state of a system in terms of the physical properties.			
2. Describe how intermolecular forces affect the state of matter.			
3. Interpret terminology related to thermodynamics and thermodynamic principles.			
4. Solve problems involving ideal and real gas systems.			
5. Solve problems using the principles of thermodynamics.			
6. Solve problems using the fundamental equations of thermodynamics.			
7. Perform experiments examining chemical and physical properties.			

### LABT 250 - Analytical Instrumentation 3

You will be introduced to a number of advanced techniques utilized in atomic spectroscopy. You will learn the theory and components of atomic absorption spectrophotometry (AAS), atomic emission spectroscopy (AES), inductively coupled plasma optical emission spectroscopy (ICP-OES) and x-ray fluorescence spectroscopy (XRF). You will apply graphical and computer software tools to create calibration curves for data obtained from instrumental analyses.

**Credit unit(s):** 2.0  
**Prerequisites:** LABT 150, LABT 151  
**Corequisites:** none  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome		Competent	Learning	None
Competent:	I can apply this outcome without direction or supervision.			
Learning:	I am still learning skills and knowledge to apply this outcome.			
None:	I have no knowledge or experience related to this outcome.			
1.	Review basic method parameters for instrumental analysis.			
2.	Apply graphical and computer software tools to create calibration curves for data obtained from instrumental analyses.			
3.	Discuss processes of emission and absorption for atomic spectroscopy.			
4.	Classify instrument components and techniques of atomic absorption spectrophotometry (AAS) and flame atomic emission spectrophotometry (FAES).			
5.	Classify instrument components and techniques of atomic absorption spectrophotometry (AAS) and flame atomic emission spectrophotometry (FAES).			
6.	Classify instrument components and techniques of X-ray fluorescence spectroscopy (XRF).			



### LABT 251 - Analytical Instrumentation 3 Lab

You will learn the software and operation of atomic absorption spectroscopy (AAS), atomic emission spectroscopy (AES), inductive coupled plasma optical emission spectroscopy (ICP-OES), and x-ray fluorescence spectroscopy (XRF). You will explore the effects of operational parameters and instrument conditions on data quality. You will prepare and analyze various real world samples on various spectroscopic techniques.

**Credit unit(s):** 3.0  
**Prerequisites:** LABT 150, LABT 151  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Conduct sample preparation techniques for atomic spectroscopy.			
2. Demonstrate the effects of operational parameters on flame atomic absorption spectroscopy.			
3. Operate the flame atomic absorption and emission spectroscopy for the analysis of unknowns.			
4. Operate the inductively coupled plasma optical emission spectroscopy for the analysis of unknowns.			
5. Operate the X-ray fluorescence spectroscopy for the analysis of unknowns.			

## LABT 297 - Laboratory Preparation Techniques in Chemistry

You will follow written and verbal instructions in the preparation of laboratory materials. You will prepare chemical solutions, and dilute acids and bases for the program laboratories. You will be involved in properly caring for and maintaining glassware and equipment, inventory procedures and ordering supplies. You will also perform general housekeeping duties required in a laboratory. You will keep accurate records and display effective teamwork skills.

**Credit unit(s):** 2.0  
**Prerequisites:** MATH 192, CHEM 179  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Demonstrate the ability to follow written and verbal instructions in the preparation of laboratory materials and performance of assigned duties.			
2. Demonstrate time-management skills in performance of assigned duties.			
3. Complete the preparation of chemical solutions to be used in program laboratories.			
4. Manage the upkeep of laboratory glassware and equipment in the labs.			
5. Use proper documentation for records of laboratory activities.			
6. Demonstrate effective teamwork skills.			

## QC 250 - Quality Control in Laboratories

You will be provided with an in-depth understanding of the quality assurance methods used in industries and organizations. You will focus on the statistical and operational aspects of quality assurance in activities (such as sample handling, instrumentation, analysis, record keeping and management). You will discuss the quality assurance protocols used by various international agencies including International Standards Organizations (ISO), the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), and Good Laboratory Practices (GLP).

**Credit unit(s):** 4.0  
**Prerequisites:** STAT 281  
**Corequisites:** QC 251  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome		Competent	Learning	None
Competent:	I can apply this outcome without direction or supervision.			
<b>Learning:</b>	I am still learning skills and knowledge to apply this outcome.			
<b>None:</b>	I have no knowledge or experience related to this outcome.			
1.	Review the history of quality and basic quality terminology as it pertains to quality management.			
2.	Apply statistical methods to evaluate significance of data.			
3.	Select the appropriate quality control chart for a given set of data.			
4.	Discuss laboratory procedures to conform to quality assurance (QA) norms.			
5.	Describe protocols for designing new analytical methods.			
6.	Compute ruggedness analyses on a given set of data.			
7.	Illustrate the various documentation processes for quality assurance programs.			
8.	Discuss the various QA models used by the International Standard Organization (ISO).			
9.	Discuss QA protocols that apply to the Chemical Technology field.			
10.	Identify the procedures required for validation of a new analytical methods and accreditation of laboratories.			

### QC 251 - Quality Control in Laboratories Project

You will conduct a small-scale in-house validation on a common laboratory instrument. You will analyze the experimental findings and determine the optimal parameters for this instrumentation. You will write a standard operating procedure for the operation of this instrumentation.

**Credit unit(s):** 1.0  
**Prerequisites:** STAT 281  
**Corequisites:** QC 250  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Identify the components of a standard operating procedure.			
2. Perform the necessary experiments for an in-house validation of a laboratory instrumentation.			
3. Write a standard operating procedure for an in-house validated method.			

## TCOM 102 - Workplace Communication

You will examine the employability skills required in the workplace. You will discuss the communication process, and practice effective interpersonal communication techniques and conflict resolution. You will use workplace writing and job search skills.

**Credit unit(s):** 3.0  
**Prerequisites:** none  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Examine fundamentals of workplace communication.			
2. Discuss conflict resolution techniques.			
3. Apply job-related interpersonal and oral communication strategies.			
4. Apply workplace writing skills.			
5. Use job search skills.			

## CHEM 293 - Physical Chemistry 2

You will examine the principles and theories of physical chemistry for phase and chemical equilibrium processes. The course will also focus on the effects of intermolecular forces on the properties of matter. You will investigate factors which influence the kinetics of reactions. Your laboratory experiments will give you the opportunity to investigate different aspects of molecular interactions.

**Credit unit(s):** 4.0  
**Prerequisites:** CHEM 292  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Calculate the equilibrium constant from thermodynamic data.			
2. Solve phase equilibrium problems for ideal and non-ideal non-reacting systems.			
3. Examine properties of electrolytic and non-electrolytic solutions.			
4. Illustrate principles of component separation using phase diagrams.			
5. Solve problems involving reaction kinetics.			
6. Recognize factors influencing reaction kinetics.			
7. Examine factors which affect fluid dynamics.			
8. Compare interactions of components in a mixture.			
9. Perform experiments examining chemical reactions.			
10. Perform experiments examining phase transitions.			

## CHEM 296 - Water Chemistry

You will be introduced to the chemistry of water as it applies to the industrial use of water. You will become familiar with the basic methods used in monitoring the water quality in power plant boilers. You will also investigate the treatment of effluent water from industrial processes to ensure it can be safely returned to the environment. The practical component will include analysis for hardness, pH, sedimentation, etc. as well as industrial site visits.

**Credit unit(s):** 4.0  
**Prerequisites:** CHEM 251  
**Corequisites:** none  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome		Competent	Learning	None
Competent:	I can apply this outcome without direction or supervision.			
<b>Learning:</b>	I am still learning skills and knowledge to apply this outcome.			
<b>None:</b>	I have no knowledge or experience related to this outcome.			
1.	Discuss the chemistry of natural waters and the impact of pollution on water quality.			
2.	Relate the processes of coagulation, flocculation, sedimentation, and filtration to water treatment.			
3.	Discuss basic procedures for the sterilization, decontamination, and disinfection of water sampling and water treatment.			
4.	Differentiate between the various demineralization processes.			
5.	Describe the principles and equipment used in the internal treatment of high pressure boiler.			
6.	Describe the methods of controlling corrosion in water treatment.			
7.	Discuss the procedures involved in the treatment of aqueous process wastes.			
8.	Perform microbiological laboratory analyses of water samples.			
9.	Perform titrimetric methods for the determination of water quality of samples.			
10.	Perform the water quality testing on unknown water samples by HACH kit testing.			

## COMM 289 - Communications 2

You will study technical writing and oral presentation skills for the technologist. You will practice research methods, report writing, and oral presentation skills appropriate to the profession.

**Credit unit(s):** 3.0  
**Prerequisites:** COMM 191, TCOM 102  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Conduct research for a technical report.			
2. Create presentation-quality technical reports.			
3. Use graphics technology to illustrate technical reports and presentations.			
4. Present technical information orally.			
5. Develop short reports.			



## ENVR 290 - Environmental Monitoring

You will be introduced to the fundamentals of the environment, its monitoring and management. You will examine the technology available for environmental soil and air monitoring. You will develop hands-on skills by performing air and soil monitoring analyses as a laboratory component. You will also learn some specific topics in the area of soil chemistry and toxicology.

**Credit unit(s):** 3.0  
**Prerequisites:** LABT 154  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Discuss environment, environmental ethics, and environmental issues.			
2. Recognize the impact of chemical technology on the environment.			
3. Describe the chemistry of air, pollution, its monitoring, and legislation.			
4. Describe briefly the chemistry of soils and their pollution, monitoring and legislation.			
5. Describe briefly the fundamentals of toxicology.			
6. Discuss the methods of waste management.			
7. Perform environmental quantitative analysis on air, gas and soil samples.			

#### LABT 252 - Analytical Instrumentation 4

You will become familiar with the instrumentation associated with elucidating molecular structures. You will study the theory and instrumental components used in a scanning ultraviolet-visible (UV-Vis) spectrometer, a Fourier transform infra-red (FTIR) spectrometer, a mass spectrometer (MS) and a nuclear magnetic resonance (NMR) spectrometer.

**Credit unit(s):** 2.0  
**Prerequisites:** LABT 150, CHEM 152  
**Corequisites:** LABT 253  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome		Competent	Learning	None
Competent:	I can apply this outcome without direction or supervision.			
<b>Learning:</b>	I am still learning skills and knowledge to apply this outcome.			
<b>None:</b>	I have no knowledge or experience related to this outcome.			
1.	Relate the theory with instrument components and techniques of scanning ultraviolet/visible (UV-VIS) spectrometry.			
2.	Relate the theory with instrument components and techniques of Fourier transform infra-red (FTIR) spectrometry.			
3.	Relate the theory with instrument components and techniques of nuclear magnetic resonance (NMR) spectrometry.			
4.	Relate the theory with instrument components and techniques of mass spectrometry.			
5.	Differentiate advantages and disadvantages of techniques in molecular spectroscopy.			

### LABT 253 - Analytical Instrumentation 4 Lab

You will be introduced to several techniques used in molecular spectroscopy. You will learn the operation of the scanning ultraviolet/visible (UV-VIS) spectrometer, the Fourier transform infra-red (FTIR) spectrometer, the mass spectrometer (MS) and the nuclear magnetic resonance (NMR) spectrometer. Your laboratory work will provide you with the opportunity to investigate the operation and preparation of samples for each of these instrumental methods and to use the data obtained from the instruments for the elucidation of chemical structures.

**Credit unit(s):** 3.0  
**Prerequisites:** LABT 150, CHEM 152  
**Corequisites:** LABT 252  
**Equivalent course(s):** none

Use a checkmark (✓) to rate yourself as follows for each learning outcome		Competent	Learning	None
Competent:	I can apply this outcome without direction or supervision.			
Learning:	I am still learning skills and knowledge to apply this outcome.			
None:	I have no knowledge or experience related to this outcome.			
1.	Perform spectroscopic analysis using ultraviolet and visible techniques.			
2.	Perform analysis using Fourier transform infrared spectrometry.			
3.	Perform analysis using a mass spectrometer.			

## PROJ 290 - Applied Research 2

You will use computer applications to analyze the data obtained during your project. You will conduct a review of recent literature relevant to your project. You will prepare a technical report and PowerPoint presentation.

**Credit unit(s):** 2.0  
**Prerequisites:** COMM 289, WORK 203  
**Corequisites:** none  
**Equivalent course(s):** none

<b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b>  <b>Competent:</b> I can apply this outcome without direction or supervision. <b>Learning:</b> I am still learning skills and knowledge to apply this outcome. <b>None:</b> I have no knowledge or experience related to this outcome.	<b>Competent</b>	<b>Learning</b>	<b>None</b>
1. Use computer applications to organize and analyze data obtained during the project.			
2. Conduct a review of recent literature relevant to the project.			
3. Prepare a technical report.			
4. Prepare a PowerPoint presentation.			
5. Deliver a presentation.			

## WORK 203 – Industry Applied Research

You will work in an organization to complete a research project. You will work with a chemist, chemical engineer, or chemical technologist to design the experiments and manage the project. You will maintain a logbook, use statistical tools to assess your results and troubleshoot minor equipment problems. You will demonstrate good communication skills and work as a team member. You will demonstrate responsibility, initiative, and accountability.

<b>Credit unit(s):</b>	0.0
<b>Prerequisites:</b>	COMP 174, CHEM 152, CHEM 179, CHEM 295, CHEM 282, LABT 152, LABT 154, MATH 192, MATH 289, PHYS 106, SFTY 185, STAT 281
<b>Corequisites:</b>	COMM 289, PROJ 290
<b>Equivalent course(s):</b>	none

<p><b>Use a checkmark (✓) to rate yourself as follows for each learning outcome</b></p> <p><b>Competent:</b> I can apply this outcome without direction or supervision.  <b>Learning:</b> I am still learning skills and knowledge to apply this outcome.  <b>None:</b> I have no knowledge or experience related to this outcome.</p>	Competent	Learning	None
1. Apply appropriate methods to solve a given scientific problem.			
2. Demonstrate testing and validation of selected method.			
3. Operate a variety of scientific instrumentation.			
4. Obtain data from scientific instrumentation.			
5. Maintain a logbook for the results of the experimental work.			
6. Use statistical tools to assess the quality of the results obtained in the project.			
7. Interpret scientific data.			
8. Trouble shoot minor equipment malfunction.			
9. Practice safety rules at the workplace.			
10. Work as team member.			
11. Demonstrate communication skills in dealing with supervisors and co-workers.			
12. Demonstrate responsibility, initiative, and accountability.			
13. Comply with QA procedures at the workplace.			
14. Preserve data for traceability and report writing.			