

Module Title:	Sampling and Separation Science
Language of Instruction:	English
Credits:	10
NFQ Level:	7
Module Delivered In	1 programme(s)
Teaching & Learning Strategies:	This module content previously outlined will be taught in a one hour theory class and one three hour practical session per week. The emphasis will be on the development of good laboratory techniques and experience in the art of chemical separations. Particular emphasis will be placed on the theory and applications of chromatography and other more traditional methods of chemical separation. To encourage an interest in the subject area students may be brought on industrial visits (where possible and appropriate) to illustrate the importance and industrial applications of the module content.
Module Aim:	The aim of this module is to impart knowledge of the importance of good sampling procedures and of the fundamental principles of separation methods used in chemical analysis and to provide practical training in this subject area with due regard to best practice and safety.

Learning Outcomes	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Describe and discuss the importance of rigorous sampling procedures
LO2	Discuss the principles and background chemistry involved in routinely used separation methods
LO3	Discuss appropriate applications of the techniques studied.
LO4	Perform the designated laboratory exercises with due regard to safety and best practice.

Pre-requisite learning	
Module Recommendations <i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
Incompatible Modules <i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements <i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>	
Successful completion of year 2 or equivalent	

Module Content & Assessment

Indicative Content

Section 1.1

Sampling (representative) of solids, liquids and gases

Section 2.2

Solvent extraction. Principles, KD, D, pH, ion association, chelation, continuous and multiple extractions, K_a , clean-up and concentration techniques, calculations.

Section 1.3

Distillation: Fractional, reduced pressure and azeotropic distillation. Raoult's Law and deviations.

Section 1.4

Chromatography: Basic principles, adsorption, partition. Stationary and mobile phases. Separation on molecular level. Band broadening. Thin layer and Paper chromatography. Stationary and mobile phases, detectors.

Section 1.5

Gas Chromatography: Basic principles, detectors, columns, stationary phases, temperature programming, internal standards and quantitation, derivatisation, GC-MS. .

Section 1.6

Ion exchange chromatography. Resin choice, pH effects, ionic strength of eluents. Ion chromatography, chemical suppression, environmental analysis.

Section 1.7

High Pressure/Performance liquid chromatography. Basic principles, columns, stationary phases, detectors, sample preparation, sample clean-up, solid phase extraction, ion pairing reagents, gradient and isocratic elution, relative response factors, quantitative and qualitative analysis.

Section 1.8

Electrophoresis: Basic principles, high and low voltage electrophoresis, paper, gel and capillary electrophoresis.

Section 1.9

Size exclusion chromatography: principles and applications

Practical

The scheduled practicals will develop the following skills: solvent extraction, distillation, GC and HPLC separations (quantitative and qualitative), use of chromatographic software Empower, ion exchange chromatography, ion chromatography, TLC analysis, gel filtration, electrophoresis

Assessment Breakdown	%
Continuous Assessment	10.00%
Practical	40.00%
End of Module Formal Examination	50.00%

Special Regulation

Students must achieve a minimum grade (35%) in both the practical/CA and final examination.

Continuous Assessment

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Examination	1 hour exam	1,2,3	5.00	n/a
Case Studies	1 hour exam	1,2,3	5.00	n/a

No Project

Practical

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	Practical Laboratory book	4	40.00	Sem 1 End

End of Module Formal Examination

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	3 hour exam	1,2,3,4	50.00	End-of-Semester

Module Workload

Workload: Full Time		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	30 Weeks per Stage	1.00
Laboratory	30 Weeks per Stage	3.00
Estimated Learner Hours	30 Weeks per Stage	2.00
Total Hours		180.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_SASES_B	Bachelor of Science (Honours) in Environmental Science	3	Mandatory