ZINS C2101: Instrumentation

Module Title:	Instrumentation
Language of Instruction:	English

Credits:	10

NFQ Level:	6

Module Delivered In	5 programme(s)

Teaching & Learning Strategies:	This module is taught as four 1-hour theory classes each week and one 3-hour practical each week over one semester. Students will be required to prepare practical reports analysing their own results. Course lecture notes, additional materials, announcements and other course-related information will be available on Blackboard, a virtual learning environment. Module-related issues or questions that may arise will be discussed at lectures. Online resources will be used. Students can contact lecturer outside of class hours to discuss feedback on reports and assessments. Blended learning and pedagogical technologies such as Blackboard Collaborate will be used where appropriate.

Module Aim:	The aim of this module is to provide the student with an introduction to the principles and operation of a range of analytical instrumentation and to develop practical laboratory skills in the use of such instrumentation.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Describe the physical principles, components and operation of analytical and process control instrumentation.
LO2	Identify sources of uncertainty in measurement in analytical instrumentation.
LO3	Demonstrate the necessary skills to evaluate equipment for a particular use and to maintain and optimise the operation of this equipment.
LO4	Identify hazards and evaluate risks in an analytical laboratory.
LO5	Apply relevant computer software for data analysis and reporting.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
Successful completion of year 1 or equivalent

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Module Content & Assessment

Indicative Content
Measurement and metrology Types of error, Identifying and analysing error and uncertainty, Accuracy and precision, Instrument specifications and performance, Reporting and interpretation of results.
Measurement of Physical Properties Physical principles and operation of polarimeter, viscometers (manual and rotational), refractometer, hydrometer, density bottle.
Principles of optics and optical systems Electromagnetic spectrum. Wavelength, frequency, energy of radiation. Absorbance, transmittance, Beer's law. Optical parameters - resolution, resolving power, dispersion.
Spectrometers and Spectroscopy Spectrophotometers and components (UV-visible and fluorescent spectroscopies, Infrared spectroscopy) Atomic spectroscopy (AAS, GF-AAS, ICP-AES). Light sources. Wavelength selection: filters, prisms, gratings, monochromators. Detectors (photomultipliers, photodiode, thermal). Characteristics of detectors (sensitivity, noise, response time, spectral range, stability), Comparison of single beam and dual beam systems. Errors in spectroscopy.
Sensors and transducers Physical principles and types of transducers for measurement of temperature, sound, pressure, flow, level. Transducer specifications - range, sensitivity, response time, linearity. Measurement of pH, O2, CO2. Introduction to Biosensors.
Data acquisition and process control. Introduction to automation in industrial processes. Signal conditioning. Single and multivariable control loops. Types of control: on/off, closed loop, proportional, integral and derivative (PID) control. Fluid dynamics and the design and operation of valves and pumps.

Assessment Breakdown	%
Continuous Assessment	20.00%
Practical	40.00%
End of Module Formal Examination	40.00%

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	20.00	Week 5

No Project

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Practical log book	3,4,5	40.00	Every Week

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	3 hour exam	1,2	40.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	4.00
Laboratory	12 Weeks per Stage	3.00
Estimated Learner Hours	15 Weeks per Stage	11.07
	Total Hours	250.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_SABTP_B	Bachelor of Science (Honours) in Biosciences with Biopharmaceuticals	3	Mandatory
CW_SAPHA_B	Bachelor of Science (Honours) in Pharmaceutics and Drug Formulation	3	Mandatory
CW_SAASC_D	Bachelor of Science in Analytical Science	3	Mandatory
CW_SABFQ_D	Bachelor of Science in Biosciences	3	Mandatory
CW_SASCI_C	Higher Certificate in Science in Applied Biology or Applied Chemistry	3	Mandatory