

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 successf | 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 RecommendationsThis is prior learning (or a practical skill) that is recommended before enrolment in this module.

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

RequirementsThis is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.

Successful completion of year 1 or equivalent



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 |