APPROVED

BIOL S8002: Bioanalytical Science

Module Details

Module Code:	BIOL S8002
Full Title:	Bioanalytical Science APPROVED
Valid From::	Semester 1 - 2018/19 (September 2018)
Language of Instruction:	
Duration:	1 Semester
Credits::	7.5
Module Owner::	Sinead Loughran
Departments:	Unknown
Module Description:	The aims of this module are to • introduce and survey the applicability of novel and emerging biosensor, mass spectrometry, flow cytometry, capillary electrophoresis, bioinformatic and nanoscience techniques. • increase students' confidence in undertaking bioanalysis, to work independently and in a research team, to become independent in designing and executing experiments and to provide good quality presentations of their findings.

Module Learning Outcome	
On successful completion of this module the learner will be able to:	
#	**Module Learning Outcome Description**
MLO1	Summarise the fundamental theoretical basis of advanced bioanalytical techniques for physical, chemical and biochemical analysis and manipulation.
MLO2	Interpret experimentally-derived data from advanced bioinformatic and bioanalytical techniques.
MLO3	Perform a range of bioanalytical experiments and report data electronically using an electronic laboratory notebook.
MLO4	Compare and contrast advanced bioanalytical techniques and qualitative and quantitative methods for the analysis and manipulation of different sample types.
MLO5	Combine theoretical knowledge and technical skills gained in the laboratory to present a portfolio tailored to an analytical science job description.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named DkIT module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).*
No recommendations listed

Module Indicative Content
Capillary Electrophoresis The general principles of capillary zone electrophoresis including sample addition, detection of separated components and the electro-endosmotic effect and its consequences; useful additives to the separation medium and their specific applications such as MECC and CIEF.
Flow Cytometry Principle of operation of flow cytometer, instrumentation, fluorescent detection, forward and side light scatter, flow cells, data interpretation, advantages, limitations and analytical capabilities.
Nanoscience/Nanotechnology Fundamental principles of nanotechnology, importance of size, properties of nanoparticles, carbon nanostructures, quantum dots, medical applications of nanotechnology. Scanning electron microscopy, atomic force microscopy and scanning tunneling microscopy as techniques in nanoscience.
Biosensors Fundamental principles of biosenors and the use of biological molecules as sensors. Principles of operation of diagnostic tests for Human chorionic gonadotropin and glucose.
Bioinformatics Use of computational tools to extract information from biological data, in silico analysis of biological data, sequencing, comparing and annotating genomes and primer design.
Mass Spectrometry Methods of ion production in mass spectrometry, the generation of MS spectra and their interpretation. MS instrumentation, ionisation techniques and mass analysers. GCMS and LCMS hyphenated techniques.
Learning and Teaching Methods Teaching methods will comprise blended delivery of lectures, online contact and practical sessions with an emphasis on deep learning in a student-centred learning approach. A variety of face-to-face and eLearning techniques will be deployed including in-class demonstrations, problem-based learning, peer assisted learning, self assessment and use of multi-media (animations, videos, eAssessments, virtual eLabs and recorded lectures).
Virtual Learning Environment The DkIT Virtual Learning Environment (Moodle) page for Analytical Science and Bioanalytical Science will be used extensively as a repository for lecture material, past exam papers, video links, online resource links, online quizzes, feedback, peer-reviewed articles as well as documents pertaining to practical lab sessions.
Electronic Laboratory Notebook Students will be introduced to an emerging tool in industry for lab data and documentation management which will be used for reporting laboratory practicals in place of the standard hard copy notebook. The ELN is a web-based product enabling the user to easily create, store, share and manage their research data. Students will be able to store and retrieve any type of documents, including Images, GraphPad Prism and MS-Office, enter rich text, spreadsheets, mathematical formulae, chemical structures, share entries or entire notebooks in small group work, capture electronic "signatures" for approvals. The use of the ELN is inherently environmentally friendly as it replaces traditionally paper-intensive documentation and storage.
Laboratory Practical Sessions The following list is designed to serve as an illustration of possible practical exercises which would illustrate key concepts and techniques: Quantitative determination using Capillary Electrophoresis, Improving CE separation, Comparison of CE and HPLC techniques for drug analysis. Method development using CE and HPLC. Synthesis of Gold Nanoparticles. Nanoparticle Analysis using Scanning Electron Microscopy.
Virtual Laboratory Experiments The use of virtual laboratory experiments in flow cytometry, nanoscience and biosensor technology will complement laboratory practical sessions and reinforce fundamental theoretical concepts (for example; students will gain access to a CHROMacademy account managed by lecturer for full access to mass spectrometry database, eLabs, assessments, webcasts, tutorials, lab simulations/ tools, peer-reviewed technical articles and application notes. Certification by CHROMacademy is also available to students upon completion of assessments).

Module Assessment

Assessment Breakdown	%
Course Work	10.00%
Project	20.00%
Practical	20.00%
Final Examination	50.00%

Module Special Regulation

Assessments

Full Time On Campus

Course Work

Assessment Type	Continuous Assessment	**% of Total Mark**	10
Marks Out Of	0	**Pass Mark**	0
Timing	S2 Week 29	**Learning Outcome**	2
Duration in minutes	0		

Assessment Description
In class workshops will focus on interpretation, observational, scientific and categorisation skills and tools, and data from journal articles or experimentally-derived data will be provided for scrutiny. Formative assessment via CATs and continuous assessment class exam.

Project

Assessment Type	Project	**% of Total Mark**	20
Marks Out Of	0	**Pass Mark**	0
Timing	S2 Week 27	**Learning Outcome**	5
Duration in minutes	0		

Assessment Description
Students will combine the scientific theory from Analytical Science in second year and Bioanalytical Science with the skills gained in analytical science during these two modules and present an individual portfolio of expertise using the Electronic Laboratory Notebook. In the portfolio students will present their Theoretical knowledge, their technical skills (lab reports) and a reflection on their Teamwork experience both inside and outside of class.

Practical

Assessment Type	Practical/Skills Evaluation	**% of Total Mark**	20
Marks Out Of	0	**Pass Mark**	0
Timing	Every Week	**Learning Outcome**	1,2,3
Duration in minutes	0		

Assessment Description
In weekly 3-hour laboratory practical sessions, students will partake in instrument demonstrations and perform advanced analytical techniques by following basic operating procedures, thereby gaining hands-on experience. Assessment will comprise four individual formal laboratory reports using an ELN, a peer assessed literature review assignment, a self-assessed method development practical assignment, a standard operating procedure writing assignment.

Final Examination

Assessment Type	Formal Exam	**% of Total Mark**	50
Marks Out Of	0	**Pass Mark**	0
Timing	End-of-Semester	**Learning Outcome**	1,4
Duration in minutes	0		

Assessment Description
End-of-Semester Final Examination

Module Workload

Workload: Full Time On Campus					
Workload Type	*Contact Type*	*Workload Description*	*Frequency*	*Average Weekly Learner Workload*	*Hours*
Lecture	Contact	Learning and Teaching Methods described in Module Content	Every Week	3.00	3
Practical	Contact	Weekly 3-hour laboratory practical sessions outlined in the Indicative Content section under Laboratory Practical Sessions	Every Week	3.00	3
Directed Reading	Non Contact	Lecture notes, Peer-reviewed papers, Textbooks, e-Resources	Every Week	3.00	3
Independent Study	Non Contact	Independent/Group study	Every Week	3.50	3.5
Online Contact	Contact	Online activities as specified on the virtual learning environment (Moodle).	Every Week	1.00	1
				Total Weekly Learner Workload	13.50
				Total Weekly Contact Hours	7.00

This module has no Part Time On Campus workload.

Module Resources

Recommended Book Resources

Harris D C. (2012), Exploring chemical analysis, 5th. WH Freeman.

Skoog D.A., Holler F.J. and Crouch S.R.. (2017), Principles of instrumental analysis, 7th. Thomson Publ.

Harris D.C.. (2007), Quantitative chemical analysis, 7th. Freeman.

Watson D.G.. (2012), Pharmaceutical analysis, 3rd. Elsevier.

Rolf Ekman et al. (2009), Mass spectrometry [electronic resource] : instrumentation, interpretation, and applications, Wiley, DkIT Ebrary Collection.

Binns, C.. (2010), Introduction to Nanoscience and Nanotechnology [online resource], Wiley, DkIT Ebrary Collection.

Sadana, A. and Sadana, N.. (2015), Biomarkers and Biosensors: Detection and Binding to Biosensor Surfaces and Biomarker Applications, Elsevier, Oxford, UK.

Editor Macey, M.. (2007), Flow cytometry; Principles and Applications, Humana Press, New Jersey.

Supplementary Book Resources

Luigi Mondello. (2011), Comprehensive chromatography in combination with mass spectrometry [online resource], Wiley, DkIT Ebrary Collection.

This module does not have any article/paper resources

Other Resources

Website, MicroSolv -Capillary Electrophoresis Site. http://www.microsolvtech.com/ce.asp.

Website, Mass Spectrometry,
http://www2.chemistry.msu.edu/faculty/re usch/VirtTxtJml/Spectrpy/MassSpec/masspe c1.htm#ms1

Website, Chemistry Hypermedia Project- Capillary Electrophoresis,
http://www.files.chem.vt.edu/chem-ed/cro ssref/ac-separations.html

Website, VLE; DkIT Moodle - Analytical Science Moodle page, Sinead Loughran. Lectures notes, images, online quizzes, video and animation links.

Website, Sam Houston State University Analytical Science,
http://www.shsu.edu/~chm_tgc/sounds/soun d.html

Website, LabArchives. Electronic Laboratory Notebook,
http://www.labarchives.com