

**ENVR S8020: Advanced Environmental
Biotechnology**

Module Details	
Module Code:	ENVR S8020
Full Title:	Advanced Environmental Biotechnology APPROVED
Valid From::	Semester 1 - 2018/19 (September 2018)
Language of Instruction:	English
Duration:	1 Semester
Credits::	7.5
Module Owner::	Caroline Gilleran
Departments:	Unknown
Module Description:	This module provides students with a detailed understanding of how biological systems, ranging from bacteria to plants, achieve environmental remediation, convert biomass to energy, can be used in the detection and monitoring of contaminants and produce biopolymers.

Module Learning Outcome	
On successful completion of this module the learner will be able to:	
#	Module Learning Outcome Description
MLO1	Critically assess and analyse the theory and practice of molecular genetic and molecular biology approaches to environmental and ecological problems.
MLO2	Compare, contrast and evaluate the fundamental principles, operating criteria and design options for the major methods of production of sustainable energy from biomass and clean technology.
MLO3	Explain, apply and assess recombinant DNA techniques in the production of novel plants and microbes to enhance environmental remediation.
MLO4	Apply the obligations of the major legislative and regulatory instruments in relation to energy recovery from biomass and solid waste management.
MLO5	Formulate informed views on current global and national environmental issues.
Pre-requisite learning	
Module Recommendations <i>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).</i>	
No recommendations listed	

Module Indicative Content
Environmental Monitoring Molecular biology and genetic principles, and their application in environmental monitoring. Research applications of molecular techniques in the field of behavioural and evolutionary ecology. Critical analysis and understanding of traditional and molecular methods to identify prokaryotes in air, soil and water samples, and environmentally important processes, such as pesticide degradation. Study and identification of biomarkers and biosensors in the environment.
Bioenergy The energy problem, sources of biomass, feedstock sustainability, global patterns of biomass use. Thermo-chemical conversion of biomass – solid biomass fuels, pre-treatment, direct combustion, gasification and pyrolysis. Anaerobic digestion - Biogas. Liquid biofuels – Bioethanol and biodiesel production. E.U. and national legislation, global utilisation and production.
Bioremediation Bioremediation strategies, biochemical pathways of biodegradation, applications of molecular biology in bioremediation, metals bioremediation, gaseous bioremediation, phytoremediation, phycoremediation. Risks associated with GMOs: Potential impacts on the environment and human health.
Clean Technology Fundamentals of clean technology. Integrated pest management and bio-control of plant diseases. Microbial polymer production and bio-plastic technology.
Sample practical classes •The use of enzyme electrodes and modern biosensors. •Fermentation of paper waste to bioethanol. •The production of biodiesel from cooking oil. •Production of bioplastic from potato starch. •Protein profile analysis of various fish species.
Site visits • Short-rotation willow coppice plantation in Clogherhead. • Industrial composting yard.
Workshops/Tutorials Sample Workshop Topics: Environmental topics making headlines. Students identify a recent environmental biotechnology news story and try to get behind the headlines to distinguish fact from fiction. Student-led debate on the ethics and the potential costs and benefits of plant biotechnology. How healthy is eating fish? A discussion on the bioaccumulation of persistent organic pollutants in fish. Student-led debate on food versus fuel.

Module Assessment	
Assessment Breakdown	%
Course Work	10.00%
Practical	40.00%
Final Examination	50.00%
Module Special Regulation	

Assessments

Full Time On Campus			
Course Work			
Assessment Type	Other	% of Total Mark	10
Marks Out Of	0	Pass Mark	0
Timing	Every Week	Learning Outcome	5
Duration in minutes	0		
Assessment Description Alternating workshops and tutorials will promote critical thinking and familiarise students with current global and national environmental and sustainability issues. Workshops will facilitate student-led debates and discussions.			
No Project			
Practical			
Assessment Type	Practical/Skills Evaluation	% of Total Mark	40
Marks Out Of	0	Pass Mark	0
Timing	Every Week	Learning Outcome	2,3
Duration in minutes	0		
Assessment Description Weekly laboratory practicals and site visits will serve to re-emphasise topics covered in lectures. Students will be assessed using a variety of methods including submission of formal reports, in-class quizzes and presentations.			
Final Examination			
Assessment Type	Formal Exam	% of Total Mark	50
Marks Out Of	0	Pass Mark	0
Timing	End-of-Semester	Learning Outcome	1,2,3,4
Duration in minutes	120		
Assessment Description End-of-Semester Final Examination			

Module Workload

Workload: Full Time On Campus

<i>Workload Type</i>	<i>Contact Type</i>	<i>Workload Description</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>	<i>Hours</i>
Practical	Contact	Practical class	Every Week	3.00	3
Lecture	Contact	Formal lecture	Every Week	2.00	2
Tutorial	Contact	Tutorial/discussion	Every Week	1.00	1
Independent Study	Non Contact	Independent study	Every Week	4.00	4
Directed Reading	Non Contact	Supplementary reading material will be posted on moodle	Every Week	2.00	2
				Total Weekly Learner Workload	12.00
				Total Weekly Contact Hours	6.00

This module has no Part Time On Campus workload.

Module Resources

Recommended Book Resources

- G. Boyle. (2012), Renewable Energy Power for a Sustainable Future, 3rd. Oxford University Press.
- D.P. Clark, N.J. Pazdernik. (2012), Biotechnology, Update ed.. Elsevier/Academic, Amsterdam.
- A. Scragg. (2005), Environmental Biotechnology, 2nd. Oxford University Press.
- S. Silveira. (2005), Bioenergy: Realising the potential, Oxford University Press.
- I. Ahmad, F. Ahmad, J. Pichtel. (2011), Microbes and microbial technology : agricultural and environmental applications, [ISBN: 1441979301].

Supplementary Book Resources

- A. Slater, N.W. Scott, M.R. Fowler. (2008), Plant Biotechnology: The genetic manipulation of plants, 2nd. Oxford University Press.
- J.D. Wall, C.S. Harwood and A.L. Demain. (2008), Bioenergy, ASM Press.

Recommended Article/Paper Resources

- Abbaszaadeh, A., Ghodadian, B., Reza Omidkhah, M., Najafi, G.. (2012), Current biodiesel production technologies: A comparative review, Energy Conversion and Management, 63, p.128.
- Guo, M., Song, W., Buhain, J.. (2015), Bioenergy and biofuels:History, status, and perspective, Renewable and Sustainable Energy Reviews, 42, p.712.
- Leung, D.Y.C., Wu, X., Leung, M.R.H.. (2010), A review on biodiesel production using catalysed transesterification, Applied Energy, 87, p.1083-1095.
- Vasco-Correa, J., Khanal, S., Manandhar, A., Shah, A.. (2018), Anaerobic digestion for bioenergy production, Bioresource Technology, 247, p.1015.

Supplementary Article/Paper Resources

- Sims, R.E.H. Mabey, W., Saddler, J.N., Taylor, M.. (2010), An overview of second generation biofuel technologies, Bioresource Technology, 101, p.1570-1580.
- Yavari, S., Malakahmad, A., Sapari, N.B.. (2015), A Review on Phytoremediation of Crude Oil Spills, Water, Air & Soil Pollution, p.226.

Other Resources

- Website, Department of Communications, Marine and Natural Resources,
<http://www.dcmnr.gov.ie/>
- Website, European Union Law,
<http://www.europa.eu.int/eur-lex>
- Website, Environmental Protection Agency,
<http://www.epa.ie>
- Website, Irish Bioenergy Association,
<http://www.irbea.org/>
- Website, Sustainable Energy Authority of Ireland,
<http://www.seai.ie>
- Website, Teagasc,
<http://www.teagasc.ie>
- Website, 'Food and Drug Administration'. FDA,
<https://www.fda.gov/>