SCIE H4123: Waste Treat & Sustainable Engy

Module Title:	Waste Treatment and Sustainable Energy
Language of Instruction:	English

Credits:	10

NFQ Level:	8

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	This module will be taught as a 3 hour theory class for thirty weeks and a total of 10 three-hour practical sessions across the year will be used to support this material. This module will be supported by site visits, independent learning such as guided reading, assignments and presentation on selected topics. The emphasis will be on the analysis and critique of the material and learning from peers. To encourage independent and active learning students will be required to access material via Blackboard or guided reading in advance of class, practicals and site visits. Following site visits/practicals student will be required to submit reports in an agreed format in a timely fashion to develop time management and report writing skills. The Blackboard ,Digital Recourses such as Youtube, Reusable Learning Objects (RLOs) and the National Digital Learning Repository will be used as applicable

Module Aim:	To explore the principles underpinning modern Chemical and Biological Waste treatment, clean technologies and sustainable energy

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Discuss the current chemical and biological technologies available for the treatment of commercial, municipal and agriculture waste
LO2	Discus the maintenance of microbial water quality in the light of current legislation.
LO3	Discuss the role of microorganisms in the degradation of organic pollutants .
LO4	Describe and evaluate the role of environmental biotechnology and in bioremediation, clean technologies and sustainable energy provision
LO5	Have an appreciation of the engineering aspects of waste management.
LO6	Demonstrate chemical strategies for the management of industrial waste.
LO7	Demonstrate a knowledge of the legal framework (to include EU directives and national regulations) for the safe disposal of wastes.
LO8	Discuss source reduction and clean technologies as a waste management strategy

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.*
No requirements listed

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Module Content & Assessment

Indicative Content
Biological Strategies: Fundamental concepts of environmental microbiology. Fundamental concepts of environmental microbiology. Biogeochemical cycles of matter. Xenobiotic, hazardous and recalcitrant wastes in the environment. Diversity of microbial metabolism. Aerobic, Anaerobic metabolism, fermentation, co-metabolism.
Biological Strategies: Overview of current waste legislation. Overview of current waste legislation. Anaerobic and aerobic waste treatment of municipal, agricultural and commercial liquid and solid waste. Suspended cell and fixed film systems. Bioreactors. Constructed wetlands. Biodegradation of solid waste, landfill and composting
Biological Strategies:Water Legislation Water legislation and microbial water quality, public health concerns emerging problems
Biological Strategies: Biodegradation theory. Biodegradation theory. Factors that determine the effectiveness of biodegradation of organic and inorganic pollutants in the environment. Degradative pathways for the biodegradation of hydrocarbons, recalcitrant, xenobiotics and hazardous wastes
Biological Strategies: In situ and ex situ bioremediation of soils and water In situ and ex situ bioremediation of soils and water. Strategies for the clean up of contaminated sites, in situ and ex situ technologies, phytoremediation.
Biological Strategies: Biotechnology and sustainable technologies. Biotechnology and sustainable technologies. Microbial production of fine and bulk chemicals , plastics and polymers, Industrial processes and clean technologies
Biological Strategies: Biological energy sources Biological energy sources, Biogas production, bio diesel, ethanol and hydrogen.Biogas generation. Natural resource recovery
Physicochemical strategies: Introduction to chemical treatment systems for air, water and solids Physicochemical strategies: Introduction to chemical treatment systems for air, water and solids. pH adjustment and control Precipitative removal of metal ions by pH adjustment. Complexing agents.
Physicochemical strategies: Chemical oxidation and reduction. Physicochemical strategies: Chemical oxidation and reduction. Organochlorines, advanced oxidation treatments. Chemical reduction. Hydrogen peroxide, hydrazine and other reductants.
Physicochemical strategies: Electrochemical processes, reactor design Electrochemical processes, reactor design. Metal recovery. Electrochemical oxidation. Ion-exchange media. Reactors and utilities waste. Particulates, vapours and liquid wastes in industrial streams. Catalysts. Low energy emulsification
Physicochemical strategies: VOCs VOCs. Microemulsions. Polymer synthesis stability and degradation.
Physicochemical strategies: Contaminated sites Contaminated sites. Contamination of land. Soils. Clays and other silicates. Cation exchange capacity. Humic and fulvic acids. Electrochemical remediation of land.
Physicochemical strategies: Clean technologies and legal framework. Clean technologies and legal framework. BATNEEC, BAT, IPC, end of pipe treatments. Legislation. Pollution acts. Source reduction and clean technologies. Case studies.
Physicochemical strategies: Introduction to energy from natural sources Introduction to energy from natural sources: solar, wind and tidal.

Assessment Breakdown	%
Continuous Assessment	10.00%
Practical	20.00%
End of Module Formal Examination	70.00%

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*
Other	Practical reports, and specific assignments	1,2,3,4,5,6,7,8	10.00	n/a

No Project

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Practical reports, and specific assignments	1,2,3,4,5,6,7,8	20.00	Sem 1 End

End of Module Formal Examination				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	No Description	1,2,3,4,5,6,7,8	70.00	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	30 Weeks per Stage	3.00
Laboratory	30 Weeks per Stage	1.00
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	4	Mandatory