

MODULE DESCRIPTION FORM

Module Information			
معلومات المادة الدراسية			
Module Title	Occupational safety and health		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	ENVT 324		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	3	Semester of Delivery	
Administering Department	Type Dept. Code	College	Type College Code
Module Leader	Diana nooraldinmustafa Abdulla abidalsttarhannon Hananreyadjarallah		E-mail diasbio86@uomosul.iq E –mail abdulla84@uomosul.edu.iq E –mail hananjarallah@uomosul.edu.iq
Module Leader's Acad. Title	مدرس	Module Leader's Qualification	
Module Tutor			e-mail E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	30/06/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims	1. The chemicals and biological laboratories should have safety and security in high companies laboratories to control risks inside laboratories like fires by gas or by chemicals and biological factors caused diseases which may be transmitted from workers to community and caused epidemic and diseases .
Module Learning Outcomes	Identify toxic and dangerous chemicals and explosive , learn the ways for dealing and saving them 2- identify disease caused and learn ways for dealing with them and saving them safety 3- learn how to prevent risks and how to deal with them 4- learn first aid to keep lives of workers in laboratories .
Indicative Contents	Indicative content includes the following. Introduction about health and safety and put basic properties of laboratories under rules of safety (7h) safety signals and precautions safety when saving chemicals and types of risks (10h) mid term exam (2h) saving biological samples and removing contamination (7h) fires inside laboratories and first aid (12h) rules of general safety inside laboratories (7h) final exam (3h) .

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Application safety inside chemical and biological laboratories and prevent risks by foccus on safety building for laboratories , good devices and training workers in laboratories for safety dealing with pathogenic germs and chemicals and how to deal them safety .
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem)		Structured SWL (h/w)	
Unstructured SWL (h/sem)		Unstructured SWL (h/w)	
Total SWL (h/sem)	50 h		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	3 ; 6 ; 10 ; 14	LO #1, 2, 3 and 4
	Assignments	1	10% (10)		
	Projects / Lab.				
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
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Week 1	Introduction about occupational safety and health
Week 2	Rules of occupational safety inside laboratories
Week 3	Laboratory safety signals
Week 4	Precautions safety when saving chemicals
Week 5	Types of risks in chemical laboratories 1
Week 6	Types of risks in chemical laboratories 2
Week 7	midterm
Week 8	Deal with biological samples and saving them safety in biological laboratories
Week 9	Remove contamination , waste management to control risks inside biological laboratories
Week 10	Fires inside laboratories and the ways to prevent them
Week 11	First aid 1
Week 12	First aid 2
Week 13	Rules of general safety inside laboratories
Week 14	Emergency response
Week 15	Review
Week 16	Final exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Lab 1:
Week 2	
Week 3	

Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	WHO Laboratory Biosafety manual , 4 th edition 2023	Yes
Recommended Texts	The manual for occupational health and safety by hashem al araji	No
Websites	https://www. Eco.mu.edu.iq	

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Remote sensing		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar
Module Code	ENVT320		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	3	Semester of Delivery	
Administering Department	Type Dept. Code	College	Type College Code
Module Leader	Abdalrahman R. Qubaa	e-mail	abdqubaa@uomosul.edu.iq
Module Leader's Acad. Title	Asst. Prof.	Module Leader's Qualification	Ph.D.
Module Tutor	Name Asmaamoayadsaadallah	e-mail	E-mail asmaa.m@uomosul.edu.iq
Peer Reviewer Name		e-mail	E-mail
Scientific Committee Approval Date	30/06/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		Semester	
Co-requisites module	Geographic Information Systems (GIS)	Semester	5

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. to provide an overview of the physical principles of remote sensing. 2. Introduce the student to the processing of remotely sensed data and the development of applications for Earth's resources management and monitoring 3. to develop specific skills in the use of spatial analysis and remote sensing software used in Geographical research. 4. how an understanding of all these can be applied to a range of environmental applications..
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the module the student should be able to: 1. Define and explain the key concepts and terminology used in remote sensing 2. Describe the electromagnetic spectrum and appreciate some of the fundamental physical properties of radiation and their suitability for use in remote sensing 3. Summaries and discuss the interactions of radiation in visible to microwave wavelengths with the terrestrial environment, and with vegetation, soils and water in particular. 4. List and discuss the advantageous features of remote sensing for the study of the Earth's environment 5. Analyse and interpret remotely sensed data. 6. Explain how thematic maps may be derived from remotely sensed data. 7. Conduct laboratory based analyses of remotely sensed and satellite data 8. Describe the properties of some major remote sensing systems. 9. Appreciate some of the ways remote sensing may be used in the study of the Earth's environment
Indicative Contents المحتويات الإرشادية	Through attending the lectures and practical sessions and through completing the assessments, you will work towards developing graduate attributes in GIS, spatial analysis, remote sensing, literacy and analytical skills

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	100	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6,6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	25	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1,6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1	30% (30)	5,8, 10,11,14	LO #1, 2, 3,4,7 and 8
	Assignments	1	2% (2)	2, 12	LO # 4 and 5
	Projects / Lab.	1	3% (3)	Continuous	All
	Seminar	1	5% (5)	13	
Summative	Midterm Exam	2 hr	10% (10)	7	LO # 1-6

assessment	Final Exam	3hr	50% (50)	16	All1-9
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Remote Sensing: History, Fundamentals.
Week 2	The main advantages of remote sensing science and technology: data acquisition, data analysis, and reference data
Week 3	The Electromagnetic Spectrum
Week 4	Energy Interactions with the Atmosphere
Week 5	Definition of Aerial Photographs: Their Types, Advantages, Disadvantages, Interpretation Keys, and a Daily Quiz
Week 6	Fundamentals of Aerial and Satellite Image Interpretation+ Satellite Sensors and Platforms
Week 7	Midterm Exam
Week 8	Spatial, Spectral, Radiometric, and Temporal Resolution of Satellite Images
Week 9	Spectral Signature of Terrestrial Targets
Week 10	Introduction to Unmanned Aerial Vehicles (Drones) in Remote Sensing + Daily Quiz
Week 11	Satellites (LANDSAT Satellite Program)
Week 12	SPOT Satellite Program
Week 13	SENTIAL Satellite Program
Week 14	Satellite Image Processing
Week 15	Review
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Lab 1: :A general introduction to the types and names of remote sensing software.
Week 2	Lab 2:: Installing the ERDAS program.
Week 3	Lab 3: : Definition of the ERDAS program interface
Week 4	Lab 4: :Vertical menus in the ERDAS program
Week 5	Lab 4: :Vertical menus in the ERDAS program
Week 6	Lab 6, : Home menu,File menu
Week 7	Lab 7:Manage Data Menu
Week 8	Lab 8:Monitoring Students' Skills in Using Menus and Applications + Daily Quiz
Week 9	Lab 9:: Raster Menu and Vector Menu
Week 10	Lab 6: : Terrain Menuand Toolbox Menu in the Program
Week 11	Lab 6: : Daily Quiz
Week 12	Lab 6:Image rectification and restoration using ERDAS
Week 13	Lab 6:Linear and Non-Linear Image Enhancement Using ERDAS+ Spatial and Spectral Image Enhancement Using ERDAS
Week 14	Lab 6:Image classification using ERDAS
Week 15	Lab 6:Review
Week 16	Lab 6: :Fainl exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?

Required Texts	BOOK: Remote sensing and image interpretation Lillesand, Thomas M.; Kiefer, Ralph W.; Chipman, Jonathan W. 6th ed Chichester John Wiley [distributor]c,2008.	NO
Recommended Texts	BOOK: Introduction to the physics and techniques of remote sensing , Elachi, Charles; Van Zyl, Jakob 2nd ed Hoboken, N.J. Wiley-Interscience Wiley series in remote sensing, 2006	No
Websites	Indicative learning resources - Web based and electronic resources	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
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Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Solid waste management and treatment		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	ENVT323		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	3	Semester of Delivery	1
Administering Department	Environmental Technology	College	Environmental sciences
Module Leader	Mohammed fakhraldeen	e-mail	milhebi@uomosul.edu.iq
Module Leader's Acad. Title	assistant professor	Module Leader's Qualification	master
Module Tutor	Omar khairalden	e-mail	Omar.k.aldeen@uomosul.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	The unit aims to manage and treat solid waste in general and focuses on the following objectives: Understanding Solid Waste: The unit aims to provide a comprehensive understanding of solid waste, including its types, sources, composition, and characteristics. This knowledge helps determine appropriate management and treatment strategies. Waste Generation and Collection: The unit aims to explore the factors that affect the generation of waste and methods of its collection. It covers topics such as waste generation rates, population growth, waste sorting, and collection techniques. Waste Reduction and Recycling: The module focuses on strategies to reduce waste generation and promote recycling. It discusses technologies such as waste reduction at source, material reuse, and recycling programs. The goal is to encourage sustainable practices and reduce the burden on landfills. Waste Treatment Technologies: The unit aims to introduce the different waste treatment technologies available for solid waste management. It covers traditional methods such as landfilling, incineration, and composting, as well as advanced techniques such as anaerobic digestion, pyrolysis, and gasification. The goal is to understand the advantages, limitations and environmental impacts of each technology. Environmental and Health Effects: The unit aims to highlight the environmental and health risks associated with improper waste management. It discusses topics such as air and water pollution, soil pollution, greenhouse gas emissions, and potential health risks for communities living near waste disposal sites. Understanding these impacts is critical to designing effective waste management systems
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The module on management and treatment of solid waste aims to equip learners with a comprehensive understanding of the subject. By the end of the module, learners should be able to: 1. Define and explain the concept of solid waste management: Understand the definition, scope, and significance of solid waste management in the context of environmental sustainability and public health. 2. Identify different types of solid waste: Recognize and categorize various types of solid waste, including municipal solid waste, hazardous waste, electronic waste, construction and demolition waste, and industrial waste. 3. Analyze the environmental and health impacts of solid waste: Evaluate the potential environmental and health hazards associated with improper solid waste management, including pollution of air, water, and soil, greenhouse gas emissions, and the spread of diseases. 4. Describe the principles of waste reduction and source separation: Understand the importance of waste reduction strategies, such as waste prevention, recycling, and composting, and explain the concept of source separation for effective waste management. 5. Assess waste collection and transportation methods: Evaluate different waste collection systems, including curbside collection, community bins, and drop-off centers, and analyze transportation methods for efficient and cost-effective waste management. 6. Examine waste treatment technologies: Explore various waste treatment technologies, such as recycling, composting, waste-to-energy conversion, incineration, and landfilling. Understand their processes, benefits, limitations, and environmental implications. 7. Evaluate the role of policy and regulations in waste management: Understand the

	importance of waste management policies, regulations, and standards at local, national, and international levels. Assess their impact on waste management practices and compliance. 8. Analyze case studies and best practices in waste management: Study real-world examples and best practices in solid waste management from different regions and sectors. Analyze their success factors, challenges, and potential for replication. 9. Develop waste management strategies and plans: Apply knowledge gained to develop effective waste management strategies and plans, considering factors such as waste characterization, waste hierarchy, stakeholder engagement, and sustainable practices. 10. Promote public awareness and community engagement: Recognize the importance of public education and community engagement in promoting responsible waste management behaviors. Develop strategies for raising public awareness and encouraging community participation. 11. Consider socio-economic aspects of waste management: Understand the social and economic dimensions of waste management, including waste management costs, financing mechanisms, job creation, and opportunities for the informal waste sector. 12. Critically analyze emerging trends and innovations in waste management: Stay updated with emerging trends, technologies, and innovations in the field of solid waste management, such as circular economy approaches, smart waste management systems, and sustainable packaging solutions.
Indicative Contents المحتويات الإرشادية	The indicative contents of a unit on solid waste management and treatment include the following topics: Chapter one: (15 hours) Introduction to solid waste management and definition of solid waste and its types The importance of solid waste management Waste generation and characterization Factors affecting waste generation rates Waste composition analysis and characterization Trends and patterns in waste generation Waste collection and transportation Chapter two: (15 hours) Collection systems and methods Transfer stations and waste transportation logistics Collection efficiency and improvement techniques

	Waste sorting and source separation The importance of sorting waste and separating the source Source separation methods and practices Benefits and challenges of waste management separated from the source Chapter three: (15 hours) <i>recycling technologies</i> <i>Recycling and resource recovery</i> <i>Recycle certain materials (paper, plastic, glass, metals)</i> <i>Recycling of demolition and construction waste</i> Chapter Four: (15 hours) <i>Composting and organic waste management</i> <i>Fertilization process and techniques</i> <i>Compost Types (Aerobic, Anaerobic)</i> <i>Benefits and applications of fertilization</i> Chapter Five: (15 hours) <i>waste-to-energy technologies</i> <i>Methods for converting waste into energy</i> <i>Energy recovery from waste and electricity generation</i> Chapter Six: (15 hours) <i>Sanitary landfill</i> <i>Its types</i> <i>Sanitary landfill methods and processes</i> <i>Estimating the amount of gases produced in the sanitary landfill site</i>
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	When designing a module on solid waste management and treatment, a combination

of effective learning and teaching strategies can enhance student engagement and understanding of the subject matter. Here are some learning and teaching strategies that can be employed:

1. **Lectures:** Traditional lectures can provide an overview of key concepts, theories, and principles related to solid waste management and treatment. Presentations can be supported with visual aids, case studies, and real-life examples to enhance understanding.
2. **Group Discussions and Debates:** Encourage students to engage in group discussions and debates on specific topics or case studies related to waste management. This strategy promotes critical thinking, problem-solving skills, and the ability to analyze different perspectives.
3. **Case Studies and Real-Life Examples:** Integrate case studies and real-life examples from different regions and sectors to illustrate the practical applications of waste management principles. This approach helps students relate theoretical knowledge to real-world scenarios.
4. **Field Visits and Guest Lectures:** Organize field visits to waste management facilities, recycling centers, or waste treatment plants to provide students with hands-on experience and practical insights. Inviting guest lecturers from the waste management industry or regulatory agencies can also offer diverse perspectives and industry expertise.
5. **Problem-Based Learning:** Present students with real or hypothetical waste management challenges and ask them to develop solutions and action plans. This approach promotes problem-solving skills, critical thinking, and teamwork.
6. **Interactive Workshops and Demonstrations:** Conduct interactive workshops and demonstrations to familiarize students with waste management technologies, such as composting or recycling processes. Hands-on activities can enhance practical understanding and skills development.
7. **Role-Playing and Simulations:** Engage students in role-playing exercises or simulations that mimic waste management scenarios. This strategy helps students understand the complexities and decision-making involved in waste management practices.
8. **Online Resources and Multimedia:** Utilize online resources, multimedia materials, and interactive tools to supplement classroom learning. Online platforms can provide additional readings, videos, quizzes, and discussion forums for students to access and engage with outside of class.
9. **Group Projects and Presentations:** Assign group projects where students can investigate specific waste management topics or develop waste management plans for a given scenario. Students can present their findings, recommendations, and outcomes to the class, fostering teamwork and communication skills.
10. **Assessments and Feedback:** Implement a variety of assessment methods, including quizzes, exams, assignments, and presentations, to evaluate students' understanding of the subject matter. Provide timely and constructive feedback to help students improve their knowledge and skills.
11. **Reflective Journals and Self-Assessment:** Encourage students to maintain reflective journals or engage in self-assessment exercises where they can critically reflect on their learning, challenges faced, and areas for

	improvement. 12. Guest Speakers and Panel Discussions: Invite experts, practitioners, or researchers in the field of solid waste management to deliver guest lectures or participate in panel discussions. This allows students to gain insights from professionals working in the industry. 13. Online Discussion Boards and Collaboration Tools: Use online discussion boards and collaboration tools to facilitate ongoing discussions, peer-to-peer learning, and knowledge sharing among students. This encourages active participation and engagement outside the classroom. 14. Reflective and Experiential Learning: Incorporate reflective and experiential learning activities, such as journaling, field observations, and critical reflection exercises, to deepen students' understanding and encourage self-directed learning. 15. Community Engagement and Service Learning: Foster community engagement by involving students in service-learning projects related to waste management. Collaborate with local organizations or municipalities to provide opportunities for students to apply their knowledge and contribute to real-world waste management initiatives.
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Student Workload (SWL)			
الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	75	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	25	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative	Quizzes	2	10% (10)	5, 10	LO #1, 2, 10 and 12

assessment	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Basic principles of waste management
Week 2	Physical and chemical methods for the test of waste
Week 3	waste generation rate
Week 4	store the waste
Week 5	collection the waste
Week 6	collection cost
Week 7	Waste transport wheels and intermediate stations
Week 8	compost
Week 9	Solid waste treatment technology
Week 10	Aerobic, anaerobic and combined burn
Week 11	waste recycle
Week 12	Sanitary landfill
Week 13	hazardous waste
Week 14	Energy recovery from burning

Week 15	Special waste such as medical waste, demolition and construction waste
Week 16	A preparatory week before the final exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	- Introduction to environmental engineering and science / Gelbert M. Masters	Yes
Recommended Texts	- Solid wastes Engineering Principles and Management Issues/ George Tchobanglous , Hilary Theisen	No
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
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Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information				
Module Title	Water supply		Module Delivery	
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	ENVT319			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	3	Semester of Delivery	2	
Administering Department	Environmental Technology	College	Environmental science	
Module Leader	Mohammed Fakhraldeen Ahmed	e-mail	milhebi@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant professor	Module Leader's Qualification	MSc.	
Module Tutor	Amna Ibrahim Ahmed Hussein Abeer Saleh Attia	e-mail e-mail	amena.ibraheem@uomosul.edu.iq abeer.aljomelly@uomosul.edu.iq	
Peer Reviewer Name		e-mail		
Scientific Committee Approval Date	/ /2025	Version Number	1.0	

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. The student acquires a skill in understanding the vocabulary of desalination plants. 2. The student acquires the cognitive skill of designing desalination plant units. 3. This semester covers the basic concepts of how raw water is treated and made potable. 4. The student acquires a skill in how desalination plants operate. 5. The student acquires a skill in conducting laboratory tests on desalinated water and matching it to drinking water specifications through relevant practical lessons.
Module Learning Outcomes	1. Introduction to the working vocabulary of water treatment plants. 2. Introduction to the types of intakes, selection criteria for intake locations, design of the suction pipe, backwash pipe, and suction wells. 3. Low-pressure pumps, operating point, and net pressure suction head (NPSH).. 4. Water and pump capacity, determining motor and pump efficiencies, and the difference between series and parallel pump connections. 5. Rapid mixing tanks and their design requirements, required rapid mixing capacity, and velocity gradient. 6. Flocculation and coagulation tanks and their design requirements, with examples of flocculation tank design. 7. Types of coagulants used, advantages, and disadvantages of each type, with solutions. 8. Derivation of the surface overflow rate and Stoke's Law, and determination of removal ratios. 9. Types of sedimentation: discrete, hindered, incompressible, and retarded sedimentation, with practical examples. 10. Types of filters and calculating the number of filters. 11. Types of downholes and calculating the sand liquefaction rate. 12. Types of sterilization and the advantages and disadvantages of each type. 13. Lecture on water softening, with examples. 14. Desalination using reverse osmosis, with examples.

	15. Chapter review.
Indicative Contents	1) Chapter One: Introduction to the general workings of water treatment plants, including intake types, intake location selection criteria, and design of the suction pipe, backwash pipe, filter, and suction wells (6 hours). 2) Chapter Two: Water and pump capacity, determining the efficiency of the motor and pump, the difference between connecting pumps in series and in parallel, the operating point, and determining the net positive absorption charge (12 hours). 3) Chapter Three: Rapid Mixing Tanks and Their Design Requirements, Requirements for Rapid Mixing, Velocity Gradient, Flocculation and Coagulation Tanks and Their Design Requirements, Explanation of Flocculation Tank Design Examples, Types of Coagulants Used, and Advantages and Disadvantages of Each Type (16 Hours) 4) Chapter Four: Surface Overflow Rate, Stoke's Law, and Determining Removal Rates, speed gradient rate, Types of Sedimentation: Discrete, discrete, Compression, and hindered Sedimentation, Practical Examples of Sedimentation Types (16 Hours). 5) Chapter Five: Types of Filters and Calculating the Number of Filters, Explanation of types of down sewers, and Calculating sand liquefaction velocity (10 Hours) 6) Chapter Six: Types of Sterilization and the Advantages and Disadvantages of Each Type, Determining the Breakpoint and the Added Chlorine Dose. (6 Hours). 7) Chapter Seven: Hard Water Treatment Methods (Water Softening) (5 Hours) 8) Chapter Eight: Types of networks transporting treated water, types of pipes used, types of seals used (4 hours). 9) Chapter Nine: Water desalination using reverse osmosis with explanation and examples (4 hours.).

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy adopted in delivering this unit is to encourage students to participate in exercises, while simultaneously enhancing and expanding their critical thinking skills. This will be achieved through interactive classes and tutorials, and by considering the type of simple experiments that include sampling activities of interest to students, in addition to conducting field visits to some of the wastewater treatment plants operating in Mosul.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعاً

Structured SWL (h/sem)	78	Structured SWL (h/w)	5
Unstructured SWL (h/sem)	72	Unstructured SWL (h/w)	5
Total SWL (h/sem)	150		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	5% (5)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	2	15% (15)		
	Report	1	10% (10)	13	LO # 7, 12 and 14
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		100% (100 Marks)

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to the general working vocabulary of water treatment plants.

Week 2	Explanation of determining the volume of service tanks using the schematic method.
Week 3	Types of intakes and selection criteria for intake sites. Design of the suction pipe, backwash pipe, strainer, and suction wells.
Week 4	Low-pressure pumps, operating point, finding the net positive suction charge.
Week 5	Water and pump capacity, finding the efficiency of the motor and pump. Difference between connecting pumps in series and parallel.
Week 6	Rapid mixing tanks and design requirements. Required power for rapid mixing. Rate gradient. Solving examples.
Week 7	Mid-term exam.
Week 8	Flocculating and coagulating tanks and design requirements. Design examples for flocculation tanks.
Week 9	Types of coagulants used and the advantages and disadvantages of each type.
Week 10	Derivation of the surface overflow rate. Stoke's law. Finding removal ratios. Solving examples.
Week 11	Types of sedimentation: discrete and sintered sedimentation. Solving examples.
Week 12	Types of filters and calculating the number of filters, types of downholes, calculating sand liquefaction velocity.
Week 13	Types of sterilization and the advantages and disadvantages of each type.
Week 14	Methods of treating hard water (water softening), types of networks, types of conveying pipes, and types of locks.
Week 15	Water desalination methods using reverse osmosis, with an explanation and an example.
Week 16	Preparing for the final exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Introduction to Experiments, Local and International Standards for Drinking Water
Week 2	Critical Odor Number and Color

Week 3	pH Test & Turbidity Test
Week 4	Hardness Test
Week 5	Jar Test
Week 6	Finding Service Tank Volume Using the Graphical Method
Week 7	Midterm Exam
Week 8	Total Dissolved Solids Test & Electrical Conductivity Test
Week 9	Determining Residual Chlorine Concentration & Break Point Dosage
Week 10	Total Nitrite Test
Week 11	Sulfate Test
Week 12	Chloride Test
Week 13	Coefficient of Uniformity (CU) Test
Week 14	
Week 15	
Week 16	

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Water supply and sewerage Authors :Terence-MGmghee and E. w. steel	NO
Recommended Texts	Water supply engineering design Authors : M. anis Al-layla, Shamim Ahmed , E. Joe Middlebrook	No

Websites	
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	Biochemistry		Module Delivery	
Module Type	Core		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	ENVT328			
ECTS Credits	4			
SWL (hr./sem.)	100			
Module Level	3	Semester of Delivery		1
Administering Department	Environmental Technologies	College	Environmental sciences	
Module Leader	Mayada Ahmed AL-Taii MaanHashimMahmood		e-mail	maysbio55@uomosul.edu.iq maanhashim@uomosul.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.	
Module Tutor	Diana Nooraldine Mustafa Abdullah AbdusttarThanoon		e-mail	Dyasbio86@uomosul.edu.iq abdullah84@uomosul.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail	
Scientific Committee Approval Date	30/6/2025	Version Number	1.0	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	General biology	Semester	1
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1- Biochemistry is concerned with the chemical composition of the components of a living cell and the course of biochemical reactions within them. 2- Study the chemical nature of the various types of nutrients and structural components of the cell and understand their biological functions within it. 3- Understand the chemical composition of carbohydrates, proteins, nucleic acids, and lipids, the differences between them, and identify the functions of each in the cells of the living organism.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Learn about biochemistry and understand the phenomenon of the unity of life among different life forms. 2- Distinguish the chemical composition of carbohydrates as structural units and nutrients for cells. 3- Understand the structural nature of proteins and their important role in the vitality of all cells, especially enzymes. 4- Identify the functions, types, and compositions of lipids. 5- Distinguish the types of nucleic acids, their compositions, and their key role in cell life. 6- Identify the effects of some pollutants on cell vitality and components.
Indicative Contents المحتويات الإرشادية	The course content includes the following: Introduction to Biochemistry - The basic chemical elements of life - Water and solutions - Laboratory safety in the chemistry lab (8 hours) Carbohydrates - Functions and types - Monosaccharides - Oligosaccharides and polysaccharides - Molisch's test - Benedict's test for sugars - Parvoid's test and

	Sullivan's test for sugars - Bayle's test and iodine test for sugars (17 hours) Amino acids - Midterm exam - Peptides - Proteins - Functions and types - Protein structures - Enzymes - Proteins, their functions, and physical properties - Amino acids - Biuret's test and Ninhydrin's test for proteins - Hopkin Cole's test and Xanthoprotic's test for proteins - Millon's test and Sakakoji's test for proteins - Cysteine and cysteine test for proteins - Identification of an unknown substance (protein or sugar) (29 hours) Lipids - Functions and types - Fatty acids - Lipid detection / Glycerol detection test (Acrolein detection) - Lipid pH (rancidity) determination test (10h) Nucleic acids / nucleotides - Nucleic acids / RNA, DNA - Effect of pollutants on biological compounds - Detection of nucleic acids (DNA, RNA) (11h)
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Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy adopted in presenting this material is to encourage students to read and discuss, and to develop the skills of scientific observation and description of phenomena, while simultaneously enhancing their critical thinking skills. This will be achieved through daily and semester tests, daily discussions, and practical observations in laboratory experiments that include conducting laboratory tests relevant to the subject matter.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (hr./sem.) الحمل الدراسي المنتظم للطالب خلال الفصل	60	Structured SWL (hr./w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (hr./sem.) الحمل الدراسي غير المنتظم للطالب خلال الفصل	40	Unstructured SWL (hr./w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.7
Total SWL (hr./sem.) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1 lec. 1 lab.	20% (10)	Lab. 5 , 11 Lec. 5 ,11	LO # 1,2 and 3
	Assignments	1	10% (10)	13	LO # 4
	Lab.	1	10% (10)	Continuous	All
	Report	-----	-----	-----	-----
Summative assessment	Midterm Exam	1 hr.	10% (10)	7	LO # 1,2,3
	Final Exam	3hr.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Biochemistry - The Chemical Elements of Life
Week 2	Water and Solutions
Week 3	Carbohydrates: Functions and Types
Week 4	Carbohydrates: Monosaccharides
Week 5	Carbohydrates: Oligosaccharides and Polysaccharides Daily Exam 1
Week 6	Amino Acids

Week 7	Midterm Exam – Peptides
Week 8	Proteins: Functions and Types
Week 9	Proteins: Protein Structures
Week 10	Enzymes
Week 11	Lipids: Functions and Types Daily Exam 2
Week 12	Fatty Acids
Week 13	Nucleic Acids / Nucleotides
Week 14	Nucleic Acids / RNA, DNA
Week 15	The Effect of Pollutants on Biomolecules
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Laboratory Safety in the Chemistry Lab
Week 2	Mollich's Test
Week 3	Benedict's Test for Sugars
Week 4	Parvoid's Test and Sullivanov's Test for Sugars
Week 5	Bayle's Test and Iodine Test for Sugars - Daily Exam 1
Week 6	Proteins, Their Functions and Physical Properties
Week 7	Amino Acids
Week 8	Biuret's Test and Ninhydrin's Test for Proteins

Week 9	Hopkin-Cole's Test and Xanthoprotic's Test for Proteins
Week 10	Millon's Test and Sakakoji's Test for Proteins
Week 11	Cysteine and Cysteine Test for Proteins - Daily Exam 2
Week 12	Identification of an Unknown Substance (Protein or Sugar)
Week 13	Lipid Test / Glycerol Test (Acrolein Test)
Week 14	Lipid pH Test (Rancidity)
Week 15	DNA and RNA Detection

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	احمد، طارق يونس و الهلالي ، لؤي عبد علي. الكيمياء الحياتية ج1 (2010). دار ابن الأثير للطباعة والنشر ، جامعة الموصل.	Yes
Recommended Texts	آل- فليح ، خولة احمد. مدخل الى الكيمياء الحياتية (2000). دار الكتب للطباعة والنشر، الموصل ، العراق.	Yes
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A –Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C –Good	جيد	70 - 79	Sound work with notable errors
	D –Satisfactory	متوسط	60 - 69	Fair but with major shortcomings

	E –Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Biotechnology		Module Delivery
Module Type	Core		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	ENVT332		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	3	Semester of Delivery	2
Administering Department	Environmental Technologies	College	Environmental sciences
Module Leader	Dr. Mayada Ahmed AL-TaiiMaanHashimMahmood	e-mail	maysbio55@uomosul.edu.iq maanhashim@uomosul.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D
Module Tutor	Diana Nooraldine Mustafa Abdullah AbdusttarThanoon	e-mail	Dyasbio86@uomosul.edu.iq abdullah84@uomosul.edu.iq
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date	30/6/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Biochemistry	Semester	UG3
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The course aims to provide students the knowledge to understanding of specialized applications related to the biological activity and metabolic capacity of living organisms, including microorganisms and plants, and their molecular biology, to clarify their role in technical fields to solving and avoiding environmental problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The course covers the details of various bioremediations for various environmental pollutants using different types of organisms and the possibility of genetically modifying them to produce strains with high biological capacity, harnessing them to preserve and sustain the environment and ensure the sustainable use of its resources.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in presenting this course is to encourage students to read and discuss, and to provide the student with the skill of scientific observation and description of the

	phenomenon, while improving their critical thinking skills at the same time. This will be achieved through daily and quarterly examinations and daily discussions.
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Student Workload (SWL)			
الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	40	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (5)	5, 10	
	Online assignments	1	10% (10)	6, 12	
	Onsite assignments	1	10% (10)		
	Lab.	2	10% (5)	3, 10	
	Report	-----	-----	=====	

Summative assessment	Midterm Exam	2 hr	10% (10)	7	
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Biotechnology: Definition and Basic Concepts
Week 2	The types of Environmental microorganisms
Week 3	Microbial systems used to treat wastewater
Week 4	Removal of household, industrial and agricultural waste
Week 5	Decomposition of organic matter, formation of humus, and production of compost
Week 6	Bioremediation of petroleum pollutants and inorganic chemicals
Week 7	Bioleaching metals from the environment, Mid Exam
Week 8	Xenobiotics in the environment and methods for their removal
Week 9	Energy and biofuel production
Week 10	Genetically modified organisms (GMOs)
Week 11	Genetic material: construction and replication of nucleic acids
Week 12	Genetic material: protein synthesis
Week 13	Gene Cloning
Week 14	Applications of microbiology in environmental monitoring

Week 15	Final exam
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Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Biosafety in Biotechnology Laboratories
Week 2	Cultivation Media and Preparation Methods
Week 3	Methods for Isolating and Cultivating Microorganisms
Week 4	Using Microscopy and Staining Techniques
Week 5	Microbial Metabolism Tests
Week 6	Biofilms
Week 7	Bioremediation of Petroleum Hydrocarbons by Microorganisms
Week 8	Bioremediation of Heavy Metals by Yeasts
Week 9	Testing Bacterial Resistance to Heavy Metals
Week 10	Biodegradation of Plastics
Week 11	Plasmid Curing
Week 12	Methods for Extracting Nucleic Acids (DNA and RNA)
Week 13	Polymerase Chain Reaction (PCR) (1)
Week 14	Polymerase Chain Reaction (PCR) (2)
Week 15	Final exam

Learning and Teaching Resources
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مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Environmental biotechnology : Concepts and Applications by Jordening, H.J. and Winter, J. (2005) John Wiley and Sons.	No
Recommended Texts	Weaver, R.F. (2012). Molecular Biology. 5 th edition, McGraw –Hill, USA.	No
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A –Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C –Good	جيد	70 - 79	Sound work with notable errors
	D –Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E –Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Molecular spectroscopy techniques		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☒ Practical ☒ Seminar
Module Code	ENVT326		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	3 (Undergraduate)	Semester of Delivery	2
Administering Department	Department of Environmental Technologies	College	College of Environmental Science
Module Leader	Assist.Prof.Dr.Eman A.M. Al-jawadi	e-mail	emanaljawadi@uomosul.edu.iq
Module Leader's Acad. Title	Assist.Prof.Dr.	Module Leader's Qualification	Ph.D./Chemistry Science -Physical Chemistry
Module Tutor	Abeer Salih Atiya Raghad Nether Ahmad Mohammed Saadallah	e-mail	abeer.aljomelly@uomosul.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	01/06/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Chemistry 1+Chemistry 2	Semester	1+2

Co-requisites module	None	Semester	
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Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	The course aims to enable students to gain a specialized understanding of how light interacts with molecules and materials. The course also covers various magnetic spectroscopic methods and their uses for studying chemical and physical properties at an advanced level.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After completing this course, students will be able to: Discuss various spectroscopic methods and compare their advantages and disadvantages Perform simple calculations based on spectroscopic data to obtain molecular properties Use spectroscopy across all magnetic spectrums to plan and perform experiments and calculations Suggest appropriate spectroscopic methods to determine specific molecular properties

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Possess a solid knowledge and in-depth understanding of the correct spectral formula, theoretical concepts of optical, infrared, and advanced magnetic spectroscopy (nuclear magnetic resonance, electron magnetic resonance), and some of their modern applications. - Be able to apply the correct formula to analyze various spectral phenomena (and corresponding data within their spectral range). - Students will be able to apply concepts of quantum physics and chemistry to optical spectroscopy (linear and nonlinear), as well as to magnetic spectroscopy (describing experiments based on pulse sequences as defined by the International Union of Pure and Applied Chemistry (IUPAC), and applying the multiplication factor formula to predict results and optimize sequences, while varying experimental parameters). - Discuss relevant spectroscopic techniques and their interdisciplinary applications. - Evaluate and compare the performance, problems, and applicability of different spectroscopic techniques in light of the chemical problems to be solved and/or the research to be conducted. - Communicate the acquired knowledge, the formula used, and the results of its application using appropriate terminology. - Learn advanced topics by reading scientific articles.
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Upon completion of this course, students will be able to assess the uncertainty and error limits of spectroscopic data, discuss and critically evaluate the results of measurements performed using molecular spectroscopy, and describe the physical principles of elementary photochemical reactions in terms of the properties of molecules and molecular systems.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	90	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	60	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	1	6% (6)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	10	LO # 5, 8 and 10
	Seminar	1	4% (4)	13	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction Spectrometer, spectrophotometer , Molecular spectroscopy definition ELECTROMAGNETIC RADIATION :Spectroscopy is the use of the absorption, emission, or scattering
Week 2	Quantum view: photons, Unification: De Broglie Hypothesis Spectrum for Molecules : Interaction of light with a sample
Week 3	Population of energy levels,Spectroscopic Transitions:Classical Theory,QuantumTheory,Transition modes and Einstein coefficients , DEGREE OF FREEDOM OF MOTION.
Week 4	PURE ROTATIONAL (MICROWAVE) SPECTRA OF DIATOMIC MOLECULES Microwave Interactions, Rotational spectroscopy (microwave spectroscopy),Application of M.W.
Week 5	Vibrational spectroscopy (infrared spectroscopy, Infrared Interactions ,Application of IR
Week 6	Roto-vibrational spectroscopy of diatomic molecules
Week 7	Mid Exam
Week 8	Electronic transitions (ultraviolet and visible spectroscopy), Visible Light Interactions , Ultraviolet Interactions , Application of UV-VIS spectroscopy.
Week 9	Raman Spectroscopy ,Application of Raman Spectroscopy
Week 10	Nuclear magnetic resonance (NMR) spectroscopy(HNMR ,CNMR)
Week 11	Nuclear magnetic resonance (NMR) spectroscopy Application of (NMR) spectroscopy
Week 12	X-ray Interactions.
Week 13	seminar
Week 14	Prepare Final Exam
Week 15	Final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Chemistry Lab Safety and Security Guidelines
Week 2	OPERATION OF THE Spectrophotometer (UV-VIS) AND DETERMINATION OF λ_{max}
Week 3	BEER'S LAW practical A. Preparation of a Calibration Curve B. Determining the Concentration of an Unknown Solution
Week 4	Estimation of an element (for example, nickel) using visible light
Week 5	Analysis of permanganate and dichromate in a mixture using visible light
Week 6	Estimation of potassium nitrate using ultraviolet light
Week 7	Infra-red Spectroscopy... Detecting functional groups in organic compounds using IR in collaboration with the central laboratory (if the device is not available in the laboratory). part .1
WEEK 8	Infra-red Spectroscopy.. Detecting functional groups in organic compounds using IR in collaboration with the central laboratory (if the device is not available in the laboratory)...part .2.
WEEK 9	A visit for practical training on various spectral-based medical devices, such as X-rays, MRI, CT, and ultrasound.
WEEK 10	Seminar
WEEK 11	Review and discussion of reports
WEEK 12	Exam preparation

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	N. E. Jacobsen “NMR SPECTROSCOPY EXPLAINED: Simplified Theory, Applications and Examples for Organic Chemistry and Structural Biology”, John Wiley & Sons, 2007. J. M. Hollas, “Modern Spectroscopy”, 4th edition, Wiley, 2003. P.W. Atkins: Physical Chemistry, 2008	Yes& net.
Recommended Texts	C.N.Banwell: Fundamentals of Molecular Spectroscopy. A. Lund, M. Shiotani, S. Shimida, “Principles and Applications of ESR spectroscopy”, Springer, New York, 2011.	Yes & net.
Websites	https://egov.uok.edu.in/eservices/syllabus/syllabusArchive/7120.PDF https://www.chem.iitb.ac.in/courses_inner/901	

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
Module Title	Environmental pollution 1		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☒ Practical ☒ Seminar
Module Code	ENVT322		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	3	Semester of Delivery	1
Administering Department	Type Dept. Code	College	Type College Code
Module Leader	Abdul SattarJubairZaben HamsaBurhan Mohammed MuhannadQasim Al-Jumaily Amena Ibrahim Ahmed	e-mail	E-mail
Module Leader's Acad. Title	teacher Assistant teacher Assistant teacher Assistant teacher	Module Leader's Qualification	Ph.D. M.Sc. M.Sc. M.Sc.
Module Tutor	Name (if available)	e-mail	E-mail: sattarjubair@uomosul.edu.iq
		e-mail	E-mail:hamsaalbazaz@uomosul.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail:aljumailymuhannad@uomosul.edu.iq
		e-mail	E-mail:amena.ibraheem@uomosul.edu.iq
Scientific Committee Approval Date	30/06/2025	Version Number	1.0

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	Identifying soil pollutants and some chemical properties, and methods for estimating them after taking samples, preparing extracts, estimating cations and anions in soil, methods for analyzing and classifying results, dealing with the soil laboratory, preparing samples for examination, and knowing the approved recommendations for reducing environmental impact.
Module Learning Outcomes	At the end of the semester, the student will gain knowledge about soil pollutants, conduct chemical analyses, and estimate cations and anions in soil. The student will be able to: take soil samples, prepare extracts, examine electrical conductivity and pH, estimate ions in soil extracts in the soil laboratory, present the results, compare them with international classifications, follow recommendations for the study soils, and pay attention to the environmental aspect.
Indicative Contents	The introductory content includes the following: 1. General principles of soil pollution, its sources, nature, and harmful effects, and an introduction to the Soil Pollution Laboratory. 2. Methods of soil sampling and organic matter estimation, and how to prepare soil extracts. 3. Soil salinity, sources of soil salinization, soil pollution by oil, soil pollution by solid waste, pesticides, and chemicals, soil pollution by chemical fertilizers, and soil pollution by organic fertilizers. 4. pH, electrical conductivity, carbonate minerals, cations and anions, heavy metals. 5. Wind erosion, measures taken to protect soil from wind erosion pollution, water erosion, measures taken to protect soil from water erosion pollution, heavy metals, introduction to radioactive pollution and sources of radioactive pollution.

Learning and Teaching Strategies

Strategies	The main strategy adopted in delivering this unit is to familiarize the student with the pollutants that occur in the soil, their source and their impact on the soil, and the extent to which they can be identified through the use of soil laboratories, conducting chemical tests, presenting the practical results, comparing them with the approved classifications, and their impact on the soil and the environmental aspect.
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Student Work load (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	70	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	55	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	
	Assignments	2	10% (10)	2, 12	
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	
Summative assessment	Midterm Exam	2hr	10% (10)	7	
	Final Exam	3hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Soil Pollution: Definition, Introduction to Environmental Quality, Sources and Nature of Soil Pollution, and Its Harmful Effects
Week 2	Soil Salinity, Sources of Soil Salinization
Week 3	Soil Pollution by Oil
Week 4	Soil Pollution by Solid Waste, Pesticides, and Chemicals
Week 5	Soil Pollution by Chemical Fertilizers
Week 6	Soil Pollution by Organic Fertilizers
Week 7	Midterm Exam
Week 8	Wind Erosion
Week 9	Measures to Protect Soil from Wind Erosion Pollution
Week 10	Water Erosion
Week 11	Measures to Protect Soil from Water Erosion Pollution
Week 12	Heavy Metals
Week 13	Introduction to Radiation-Pollution – The Difference Between Ionizing and Non-Ionizing Radiation – Alpha Particles, Beta Particles, Gamma Rays, and Neutrons – Physical Units for Measuring Radiation
Week 14	Sources of Radiation Pollution (Natural – Artificial) – Health Effects of Radiation (Acute – Chronic) – Environmental Effects – Radiation Protection Methods – International and Local Laws and Regulations
Week 15	Final exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
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Week 1	Lab 1: Introduction to Soil Pollutionlab
Week 2	Lab 2: Methods of soil sampling
Week 3	Lab 3: Organic matter
Week 4	Lab 4: Soil extraction procedures
Week 5	Lab 5: pH meter
Week 6	Lab 6: Electrical Conductivity (EC)
Week 7	Lab 7: Midterm Exam
Week 8	Lab 8: Carbonate minerals
Week 9	Lab 9: $K^+ + Na^+$
Week 10	Lab 10: $Mg^{++} + Ca^{++}$
Week 11	Lab 11: $HCO_3^- + CO_3^{=}$
Week 12	Lab 12: Cl^-
Week 13	Lab 13: Heavy metals

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Soil Pollution. Origin, Monitoring & Remediation.2008. Ibrahim A. Mirsal	YES
Recommended Texts	Soil Pollution: From Monitoring to Remediation,2nd Edition,2025. Editors: Teresa Rocha-Santos, AnabelaCachada, Armando C. Duarte	No
Websites	https://www.alibris.com/search/books/subject/Soil-pollution	

Grading Scheme				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	Geographic information systems		Module Delivery	
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☒ Practical ☐ Seminar	
Module Code	UoB12345			
ECTS Credits	5			
SWL (hr/sem)	125			
Module Level	3	Semester of Delivery		2
Administering Department	Type Dept. Code	College	Type College Code	
Module Leader	Raid Mahmood Faisal		e-mail	raidalfaisalm@uomosul.edu.iq
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	M.Sc.
Module Tutor	Asmaa moayad saadallah		e-mail	Asmaa.m@uomosul.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail	
Scientific Committee Approval Date	01/06/2023	Version Number	1.0	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Employ GIS techniques and programs in diagnosing and solving environmental problems. 2. The concept of coordinate systems and maps projections. 3. This course deals with the basic concepts of spatial and attribute data that form the basis of a geographic information system. 4. The concept of vector data and raster data models and the mechanisms for dealing with them. 5. Production and design of digital maps.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Identify the tasks or applications of the geographic information system. 2. Stages of creating and digitizing layers within ArcGIS. 3. Summarize what is meant by the geographical coordinate system, the projection coordinate system, and the UTM projection system. 4. Discuss the interaction or interrelationship of spatial data with attributes, which is the basis for building a GIS. 5. Identify the vector and raster data model properties. 6. Learn about the structure of spatial databases. 7. Determine the data types in the attribute tables and the stages of their formation. 8. Identify methods for the symbolization and classification of data in GIS. 9. An explanation of some spatial analysis tools and applications within the Arc Toolbox program. 10. Learn about the stages of preparing spatial interpolation maps within the Geostatistical Analyst 11. Learn the principles of designing and producing maps.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A (Theory)</u> Introduction to Geographic Information System (GIS) Definition of the system, stages of its development and applications, components of the Geographic Information System (GIS), applications of GIS in the field of environment, data sources used in building the system (primary and secondary sources) Coordinate systems and map projections, geodetic system (Datum), Transverse Mercator Projection System

	(UTM).[16 hrs]. Part B (Practical) Introduction of ArcGIS, Arc Catalog, Arc Map (explanation of the program interface and toolbar), Georeferencing Imagery, Digitization Operations, and Advanced Editing , Editor toolbar. [24 hrs] <u>Part C (Theory)</u> Digital representation of data in GIS , Vector data model, Raster data model, Geodatabase architecture, Non-spatial data, Coding and classification of data in GIS, Cartography and map production [14 hrs]. <u>Part D (Practical)</u> Building or generating metadata tables (attributes tables), field calculator, calculate geometry, design, output and print map layout. [21 hrs]
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Learning and Teaching Strategies			
استراتيجيات التعلم والتعليم			
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.		
	Student Workload (SWL)		
الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem)	78	Structured SWL (h/w)	5

الحمل الدراسي المنتظم للطالب خلال الفصل		الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	47	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.67
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation					
تقييم المادة الدراسية					
		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
التقييم التكويني	الامتحانات اليومية	3	30 % (30)	4,6,9,11	LO #1, 2, 10 and 11
	الواجبات اللاصفية (البينية)	2	0 % (0)		LO # 3, 4, 6 and 7
	المختبر. / المشاريع	2	10 % (10)	Continuous	All
التقييم الختامي	إختبار نصف الفصل	2 hr	10% (10)	7	LO # 1-7
	الامتحان النهائي	3hr	50% (50)	15	All
التقييم الإجمالي			100% (100 درجات)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Geographic Information System (GIS), System definition, stages of development and applications.
Week 2	Components of (GIS), applications of (GIS) in the field of environment

Week 3	Data sources adopted in building the system (primary sources and secondary sources) p1
Week 4	Data sources adopted in building the system (primary sources and secondary sources) p2
Week 5	Mercator Transverse Projection System (UTM) p1
Week 6	Mercator Transverse Projection System (UTM) p2
Week 7	Coordinate systems and map projections, geodetic system (Datum)
Week 8	Mid-term Exam + Unit-Step Forcing, Forced Response
Week 9	Digital representation of data in GIS, (vector data model),(Raster data model) p1
Week 10	Digital representation of data in GIS, (vector data model),(Raster data model) p2
Week 11	Geodatabase structure, non-spatial data (attributes tables)
Week 12	Symbolization and classification of data in GIS p1
Week 13	Symbolization and classification of data in GISp2
Week 14	Cartography and map production
Week 15	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Lab 1: Introduction of ArcGIS, Arc Catalog
Week 2	Lab 2: Arc Map (explanation of the program interface and toolbar)
Week 3	Lab 3: Georeferencing ImageryP1
Week 4	Lab 3: Georeferencing Imagery P2+ Daily exam

Week 5	Lab 5: Digitization Operations P1
Week 6	Lab 6: Digitization Operations P2
Week 7	Lab 7: Digitization Operations P3
Week 8	Lab 8: Advanced Editing, Editor toolbar
Week 9	Lab 9: Daily exam
Week 10	Lab 10: Build an attribute data P1
Week 11	Lab 11: Build an attribute data P2
Week 12	Lab 12:Field calculator, calculate geometry
Week 13	Lab 13: Symbolization and classification of data in GIS
Week 14	Lab 14:Design, production and printing of the map (layout)
Week 15	Lab 15:Review

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	مبادئ علم نظم المعلومات الجغرافية ، د. جمعة محمد داؤود	No
Recommended Texts	نظم المعلومات الجغرافية وقواعد البيانات	No
Websites	https://www.youtube.com/@GomaaDawod	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	ENVIRONMENTAL SUSTAINABILITY		Module Delivery	
Module Type	Core		☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	ENVT330			
ECTS Credits	3			
SWL (hr/sem)	75			
Module Level	3	Semester of Delivery		2
Administering Department	Type Dept. Code	College	Type College Code	
Module Leader	Tahseen ALI Husain		e-mail	tahssenali1967@uomosul.edu.iq
Module Leader's Acad. Title	lecturer		Module Leader's Qualification	Ph.D.
Module Tutor	YasirHazimYounus		e-mail	yasir.younis@uomosul.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail	
Scientific Committee Approval Date	01/06/2023	Version Number	1.0	

Relation with other Modules				
العلاقة مع المواد الدراسية الأخرى				
Prerequisite module	Math 1, Math 2, Environmental Science		Semester	
Co-requisites module	Renewable energy		Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Explain concept of sustainability and sustainable development 2. Explain tools of sustainability. 3. Explain steps life cycle assessment 4. explain methods to implement greentechnology.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. explain the concept of sustainability 2. explain environmental management System 3. describe life cycle assessment for products made of different material 4. describe the concept of sustainability to develop sustainable habitat 5. explain different practices to move industries towards sustainability 6. discuss various methods to implement green technology 7. explain of the natural resource and environmental challenges that will face in designing for sustainability 8. explain analysis frameworks for addressing environmental issues and sustainability 9. explain with a description of the selection of green and sustainable materials 10. explain a series of principles to make engineering designs more sustainable and tools that can be used to evaluate.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Introduction to Sustainability Definitions, Sustainability Challenge, energy, materials used, water, Environmental Emissions, requirements for sustainability, approaches toward sustainability. [6hrs] concepts of sustainable development: three pillar model, egg of sustainability model, Atkisson's pyramid model, prism model. Sustainable Development Goals .

	Tools for Sustainability
	Environmental management System (EMS), life cycle assessment (LCA) Life cycle
	[6hrs]
	Life cycle framework
	Defining life cycles, steps for life cycle assessment : goal definition and scope, inventory analysis, footprint assessment, carbon footprint, water footprint
	[6hrs]
	Life cycle networks
	Process network analysis (mathematical framework, allocation method)
	Input- output analysis (mathematical framework, environmental extended input-output method)
	Hybrid models
	[6hrs]
	Green, Sustainable Materials
	Environmental and Natural Resource Use Footprints of Material Extraction and Refining,Tracking Material Flows,Environmental Releases.
	[12hrs]
	Design for Sustainability: Economic, Environmental, and Social Indicators
	Economic Performance Indicators, Environmental Performance Indicators, Social Performance Indicators.
	Sustainable Habitat - Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment (GRIHA) , leadership in energy and environmental design (LEED) rating, energy

	efficient buildings, sustainable cities. [9hrs]
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in presenting this module is for students to participate in exercises, with reports for case studies. This will be achieved through classes, interactive tutorials and through reading on subject topics

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	45	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	30	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	15% (15)	3, 10	LO #1, 2, and 3
	Assignments	4	15% (15)	4, 12	LO # 2, and 3
	Report	1	10% (10)	11	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1,2,3
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Definitions, Sustainability Challenge, energy, materials used, water, Environmental Emissions, requirements for sustainability, approaches toward sustainability.
Week 2	concepts of sustainable development: three pillar model, egg of sustainability model, Atkisson's pyramid model, prism model. Sustainable Development Goals
Week 3	Environmental management System (EMS), life cycle assessment (LCA) Life cycle
Week 4	Defining life cycles, steps for life cycle assessment : goal definition and scope, inventory analysis
Week 5	footprint assessment, carbon footprint, water footprint
Week 6	Life cycle networks Process network analysis (mathematical framework, allocation method)
Week 7	Mid-term Exam
Week 8	Input- output analysis (mathematical framework, environmental
Week 9	extended input-output method
Week 10	Hybrid models
Week 11	Green, Sustainable Materials Environmental and Natural Resource Use Footprints of Material Extraction and Refining
Week 12	Tracking Material Flows, Environmental Releases
Week 13	Design for Sustainability: Economic, Environmental, and Social Indicators
Week 14	Economic Performance IndicatorsEnvironmental Performance Indicators, Social Indicators.

Week 15	Sustainable Habitat - Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment (GRIHA) , leadership in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	R. L. Rag and LekshmiDinachandranRemesh. Introduction to Sustainable Engineering. 2nd Edition, PHI Learning Pvt. Ltd., 2016.	Yes
Recommended Texts	D. T. Allen and D. R. Shonnard. Sustainability Engineering: Concepts, Design and Case Studies, 1st Edition, Prentice Hall, 2011	No
	A.S. Bradley, A. O. Adebayo, P.Maria. Engineering applications in sustainable design and development, 1st Edition, Cengage learning, 2016	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/environmental-science-and-sustainability	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Water Quality		Module Delivery
Module Type	core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	ENVT331		
ECTS Credits	3		
SWL (hr/sem)	75		
Module Level	3	Semester of Delivery	1
Administering Department	Type Dept. Code	College	Type College Code
Module Leader	Dr. Hazim Jumaa Mahmood	e-mail	hazimjm@uomosul.edu.iq
Module Leader's Acad. Title	Assistant Professor	Module Leader's Qualification	Ph.D.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name		e-mail	E-mail
Scientific Committee Approval Date	01/06/2023	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	6. The module is intended to equip students with skills in the field of water monitoring and quantitative analysis of critical water quality parameters. It also brings in those aspects of chemistry which are important for water quality assessment, management and pollution control. 7. Learn how to classify water and determine its suitability for various uses.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	12. Create a water-sampling plan. 13. The ability to identify the main sources of chemical ions in water 14. Understand and characterize important physical, chemical and biological water quality parameters and their implication in water quality issues 15. Calculate concentrations, perform unit conversions, and validate analytical data 16. Analyze and interpret water quality data 17. Application of water quality indices and assessment of water quality for various uses 18. Perform Water classification. 19. Understanding the water quality determinants and standards
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. General properties of water. [3hrs] Water sampling. [2hrs] Physical, chemical and biological parameters. [16hrs] Analysis of Water Quality Parameters. [20hrs] Water quality indices and standards. [6hrs] Irrigation water quality. [5hrs]

	hydrochemical classification of water types. [7 hrs]
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Learning and Teaching Strategies			
استراتيجيات التعلم والتعليم			
Strategies	This course will be delivered through a combination of lectures, discussions, exercises, and laboratory analyses. The key strategy for presenting this subject will be to stimulate student participation while also polishing and strengthening their critical thinking skills. Student learning will be assessed through graded laboratory tests and examinations covering lecture content and through practical quizzes on lab exercises.		
Student Workload (SWL)			
الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem)	63	Structured SWL (h/w)	4
الحمل الدراسي المنتظم للطالب خلال الفصل		الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem)	12	Unstructured SWL (h/w)	1
الحمل الدراسي غير المنتظم للطالب خلال الفصل		الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem)	75		
الحمل الدراسي الكلي للطالب خلال الفصل			

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1- 5
	Assignments	1	10% (10)	2, 12	LO # 1-6

	Projects / Lab.	2	10% (10)	Continuous	All
	Report	1	10% (10)	13	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-4
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction
Week 2	Water sampling
Week 3	Physical parameters of water quality– Part One
Week 4	Physical parameters of water quality– Part Two
Week 5	Chemical parameters of water quality– Part One
Week 6	Chemical parameters of water quality– Part Two
Week 7	Mid-term Exam
Week 8	Trace elements in water
Week 9	Heavy metals in water.
Week 10	Biological properties of natural waters
Week 11	Drinking Water Quality
Week 12	Water quality indices
Week 13	Irrigation water quality

Week 14	hydrochemical classification of water types
Week 15	Water Quality Regulations
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Electrical conductivity measurement and Solids Analysis
Week 2	Lab 2: Field Sampling and Analysis of field Water Quality Parameters (Temperature, pH, turbidity, Electrical conductivity and Total Dissolved Solids)
Week 3	Lab 3: Determination of hardness
Week 4	Lab 4: Determination of calcium and magnesium ions
Week 5	Lab 5: Determination of carbonate and bicarbonate ions
Week 6	Lab 6: Determination of chloride ions
Week 7	Lab 7: Determination of sulphate ions
Week 8	Lab 8: Determination of sodium and potassium ions
Week 9	Lab 9: Units conversion and salts formula calculation
Week 10	Lab 10: hydrochemical classification of water types (Stiff diagram)
Week 11	Lab 11: hydrochemical classification of water types (Piper diagram)
Week 12	Lab 12: Water classification for irrigation uses

Learning and Teaching Resources
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مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Water Quality: An Introduction 2nd Edition (2015), Claude E. Boyd.	
Recommended Texts	Clean Water: An Introduction to Water Quality and Water Pollution Control, 2nd Edition (2003), Kenneth M. Vigil, P.E.	
Websites		

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Environmental Costs		Module Delivery
Module Type			☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code			
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	4	Semester of Delivery	1
Administering Department	Type Dept. Code	College	Type College Code
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	Ph.D.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	01/06/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None		Semester
Co-requisites module	None		Semester

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. To provide students with the fundamental knowledge and skills related to the concept of environmental costs and their various classifications in environmental, educational, and industrial facilities and projects. 2. To enable students to understand and apply methods for measuring and analyzing environmental costs, including internal and external costs, and to relate these costs to environmental performance and sustainability strategies. 3. To train students to incorporate environmental considerations and environmental costs into managerial and technological decision-making, thereby contributing to pollution reduction and the efficient use of resources. 4. To develop students' ability to assess the role of environmental cost accounting and prepare environmental reports for organizations and companies.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Define and explain the fundamental concepts of environmental costs, environmental accounting, and environmental financial management. 2. Classify environmental costs into prevention and control costs, appraisal and auditing costs, internal failure costs, and external failure costs. 3. Measure external environmental costs and assess the impacts of pollution and industrial activities on society and the environment. 4. Apply environmental cost accounting techniques, such as Activity-Based Costing (ABC) and Life Cycle Costing (LCC). 5. Analyze and interpret environmental financial reports and use environmental cost information to assess environmental impacts and support green technology decision-making. 6. Propose technical and economic solutions to reduce waste and environmental costs in industrial and service facilities.
Indicative Contents المحتويات الإرشادية	1. Introduction and Conceptual Framework of Environmental Costs (9 hours): Concept, significance, the relationship between environmental technologies and environmental economics, and contemporary environmental challenges. 2. Classification and Structure of Environmental Costs (12 hours): Prevention costs, appraisal and measurement costs, internal failure costs (waste and solid waste management), and external failure costs (compensation and environmental damages). 3. Measurement and Analysis of Environmental Costs (15 hours): Direct and indirect measurement methods, hidden environmental costs, external costs (externalities), and environmental damage assessment. 4. Techniques and Tools for Environmental Cost Management (12 hours): Life Cycle Costing (LCC), Environmental Activity-Based Costing (Environmental ABC), and environmental auditing. 5. Environmental Costs, Decision-Making, and Sustainability (12 hours): Environmental Cost-Benefit Analysis (CBA), investment in clean pollution-control technologies, and environmental cost reporting and disclosure.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	This theoretical course is delivered through interactive lectures, scientific case studies addressing real-world environmental projects and challenges, and group discussions. The teaching strategy focuses on fostering students' critical thinking and establishing connections between environmental technologies and their financial and economic aspects. Student learning is assessed through quizzes, homework assignments, as well as midterm and final examinations.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	15% (15)	3, 12	LO #1, 2, 4, 5 and 7
	Assignments	3	15% (15)	Continuous	All
	Projects / Lab.				
	Report	1	10% (10)	13	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Environmental Costs: Concepts, environmental activities, and their relationship to environmental technologies.
Week 2	Environmental Accounting and Environmental Financial Management: Objectives and significance for organizations and industrial facilities.
Week 3	Environmental Prevention Costs (Prevention Costs).
Week 4	Environmental Appraisal, Measurement, and Auditing Costs (Appraisal Costs).
Week 5	Internal Failure Costs and Waste Management (Internal Failure Costs).
Week 6	External Failure Costs and Environmental Compensation (External Failure Costs).
Week 7	Measurement of Environmental Externalities and Their Social and Environmental Impacts.
Week 8	Midterm Exam
Week 9	Methods for Assessing Hidden and Contingent Environmental Costs (Hidden & Contingent Environmental Costs).
Week 10	Application of Environmental Activity-Based Costing (EABC).
Week 11	Life Cycle Costing (LCC) for Products and Environmental Technologies.
Week 12	Environmental Cost-Benefit Analysis (CBA) for the Selection of Green Technologies.
Week 13	The Role of Environmental Costs in Investment Decision-Making, Pollution Reduction, and Waste Management.
Week 14	Environmental Financial Reporting and Disclosure and Applications of Sustainability.
Week 15	Comprehensive Case Study: Evaluation of Environmental Costs for an Industrial or Service Facility and Approaches to Cost Reduction and Environmental Improvement.
Week 16	Final Exam

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Schaltegger, S., Bennett, M., Burritt, R. L., & Jasch, C. (Eds.). (2008). <i>Environmental Management Accounting for Cleaner Production</i> . Springer.	
Recommended Texts	Schaltegger, S., & Burritt, R. (2017). <i>Contemporary Environmental Accounting: Issues, Concepts and Practice</i>. Routledge.	
Websites	- IFAC - Environmental Management Accounting Statements - United Nations Division for Sustainable Development (UNDSD) - EMA Guidelines	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	الطاقة المتجددة		Module Delivery	
Module Type	Core		☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	ENVT335			
ECTS Credits	5			
SWL (hr/sem)	125			
Module Level	4	Semester of Delivery		1
Administering Department	Type Dept. Code	College	Type College Code	
Module Leader	Tahseen ALI Husain		e-mail	tahssenali1967@uomosul.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.	
Module Tutor	YasirHazimYounus		e-mail	yasir.younis@uomosul.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail	
Scientific Committee Approval Date	01/06/2023	Version Number	1.0	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Math 1, Math 2, thermodynamics	Semester	
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. تزويد الطلاب بفهم شامل لمصادر وتقنيات الطاقة المتجددة، وتطبيقاتها. 2. استكشاف أساسيات تقنيات الطاقة المتجددة المختلفة، بما في ذلك مزاياها وعيوبها.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. يشرح مفهوم الطاقة، أنواعها (المتجددة وغير المتجددة)، وحدات قياسها الأساسية، والفرق بين طاقة الوقود الأحفوري والطاقة المتجددة، مع ذكر مصادر الطاقة المتجددة 2. يصف أساسيات الطاقة الشمسية وطاقة الرياح، ويحسب المسائل الحسابية المتعلقة بتصميم وتحليل الخلايا الشمسية، ثم يقارن بين تطبيقات تحويل الطاقة الشمسية إلى طاقة كهربائية (خلايا كهروضوئية) وتطبيقات تحويلها إلى حرارة (مجمعات حرارية)، ويحدد أنواع الخلايا الشمسية مع ميزة وعيب لكل منهما، ويذكر تطبيقين يبينان لطاقة الرياح (مثل ضخ المياه، تهوية الأحواض، تشغيل محطات معالجة الصرف الصحي). 3. يشرح أربعة مصادر متجددة: الطاقة الحيوية (وكيفية إنتاجها، أنواعها، والوقود الحيوي)، طاقة باطن الأرض (أساسياتها)، طاقة المد والجزر، والطاقة الكهرومائية، ثم يحلل مسائل حسابية تشمل هذه الأنواع (بما في ذلك حساب القدرة المنتجة، الكفاءة، أو الطاقة المتوقعة)، ويقيم أي من هذه المصادر الأربعة هو الأكثر ملاءمة لمنطقتين مختلفتين (منطقة ساحلية ومنطقة جبلية داخلية) مع تبرير إجابته بثلاثة أسباب لكل منطقة. 4. يصف خلايا الوقود وأنواعها وميزاتها، ويشرح مفهوم الطاقة الحرارية للمحيطات، ثم يصمم مقترحاً لمشروع بيئي صغير (سواء كان: تشغيل مضخة مياه، محطة معالجة صرف صحي صغيرة، أو نظام إنارة لموقع بيئي ناءٍ) يعتمد على دمج مصدرين مختلفين للطاقة المتجددة (على أن يكون أحدهما الخلايا الوقودية أو الطاقة الحرارية للمحيطات أو أي مصدر آخر تم دراسته)، ويبرر اختياره للمصدرين بثلاث فوائد بيئية وتقنية.
Indicative Contents المحتويات الإرشادية	يتضمن المحتوى الإرشادي ما يلي مقدمة في الطاقة التعريفات، أنواع الطاقة، وحداثتها، الوقود الأحفوري واثراً استخداماً، الطاقة المتجددة، مصادر الطاقة المتجددة [4 hrs] الطاقة الشمسية أساسيات الطاقة الشمسية، أجهزة قياس الطاقة الشمسية تطبيقات الطاقة الشمسية، الخلايا الكهروضوئية [8 hrs] طاقة الرياح أساسيات طاقة الرياح، تطبيقات طاقة الرياح، توربينات الرياح [8hrs] طاقة الكتلة الحيوية تعريف الكتلة الحيوية، موارد الكتلة الحيوية، طرق تحويل الكتلة الحيوية إلى طاقة، الوقود الحيوي، أصناف الوقود الحيوي [16hrs] الطاقة الحرارية الأرضية مصادر حرارة باطن الأرض، تطبيقات الطاقة الحرارية الأرضية، محطات الطاقة الحرارية الأرضية، مزايا ومساوئ محطات الطاقة الحرارية الأرضية [8hrs] الطاقة الكهرومائية

	اساسيات الطاقة الكهرومائية , محطات الطاقة الكهرومائية, طاقة المد والجزر [8hrs] الطاقة الحرارية للمحيطات انظمة تحويل الطاقة الحرارية للمحيطات [8hrs] خلايا الوقود , انواع خلايا الوقود , مزايا استخدام خلايا الوقود [8hrs]
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	الإستراتيجية الرئيسية التي سيتم تبنيها في تقديم هذه المادة الدراسية هي مشاركة الطلاب في التمارين ، مع تقديم تقارير تتضمن دراسة حالة. سيتم تحقيق ذلك من خلال الفصول والبرامج التعليمية التفاعلية ومن خلال القراءة في مواضيع المادة الدراسية

Student Workload (SWL)			
الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	60	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	65	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعيا	4.3
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	125		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	15% (15)	3, 10	LO #2, 3, 4 and 6
	Assignments	4	15% (15)	4, 12	LO # 1, 5, 7 and 8
	Report	1	10% (10)	11	All
Summative assessment	Midterm Exam	1hr	10% (10)	7	LO # 1-7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	مفهوم الطاقة وانواع الطاقة وحدات الطاقة مفهوم الطاقة المتجددة وانواع الطاقة المتجددة الفرق بين طاقة الوقود الاحفوري والطاقة المتجددة
Week 2	الطاقة الشمسية أساسيات الطاقة الشمسية
Week 3	تطبيقات الطاقة الشمسية بتحويلها للطاقة كهربائية وحرارة
Week 4	الخلايا الشمسية وانواعها
Week 5	مسائل حسابية في تصميم وتحليل الخلايا الشمسية
Week 6	طاقة الرياح واساسيات تطبيقات طاقة الرياح
Week 7	إختبار نصف الفصل
Week 8	الطاقة الحيوية وكيفية إنتاجها وانواع الطاقة الحيوية

Week 9	الوقود الحيوي
Week 10	طاقة باطن الارض واساسياتها
Week 11	طاقة المد والجزر
Week 12	حل مسائل تشمل انواع الطاقة المذكورة سابقا
Week 13	الطاقة الكهرومائية
Week 14	الخلايا الوقودية وانواعها وميزاتها
Week 15	الطاقة الحرارية للمحيطات
Week 16	أسبوع تحضير قبل الامتحان النهائي

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	S. C. Bhatia_ R. K. Gupta - Textbook of Renewable Energy- Woodhead Publishing India PVT. Limited (2019)-2	Yes
Recommended Texts	(Energy and the environment) Nelson, Vaughn_ Starcher, Kenneth - Introduction to renewable energy-CRC Press (2016)	No
	Sergio C. Capareda (Author) - Introduction to Renewable Energy Conversions-CRC Press (2019)	No

Websites	https://www.coursera.org/courses?query=renewable%20energy
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Wastewater treatment		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☒ Tutorial ☒ Practical ☒ Seminar
Module Code			
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	4	Semester of Delivery	
Administering Department	Environmental Technologies	College	Environmental sciences
Module Leader	Rasha Khalid sabri	e-mail	rashamhemid@uomosul.edu.iq
Module Leader's Acad. Title	Assistant Professor	Module Leader's Qualification	PhD.
Module Tutor	Roua Mudhaffar Yunus	e-mail	roaoyouns@uomosul.edu.iq
Peer Reviewer Name	Raghad Nadhir Ahmed	e-mail	Raghad.nadhear@uomosul.edu.iq
Scientific Committee Approval Date	31/05/2026	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	1
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1- Acknowledge the student with the types of wastewater 2- This course deals with the basics of wastewater treatment and management 3- Acknowledge the student with the characteristics of wastewater, especially municipal ones 4- How to treat this wastewater? 5- How to design wastewater units? 6- How to dispose of wastewater in a safe manner. 7- To develop problem-solving skills and understanding of wastewater application 8- Doing design calculations for the main treatment units.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, students will be able to: 1. Classify the main types of wastewater and describe their physical, chemical, and biological characteristics. 2. Explain the main stages of wastewater treatment, including preliminary, primary, secondary, and tertiary treatment processes. 3. Analyze wastewater flow variations and calculate important design parameters such as hydraulic loading, organic loading, detention time, and settling velocity. 4. Apply design calculations and laboratory skills to evaluate and design main wastewater treatment units and prepare clear technical reports.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Fundamentals, introduction to wastewater treatment, types of wastewater, the concept of treatment, treatment methods, unit operation, unit process, Types of Impurities in wastewater, measurement of TSS, TDS, and TVSS. [5 hr] Selection of treatment systems, functions of treatment plant unit, the concept of (preliminary treatment system, primary treatment, secondary treatment and tertiary treatment). [5 hr] Strength and characteristics of wastewater, the concept of mass load, Variation in Mass loading, wastewater flow rate and its fluctuation, Daily variation, seasonal variation, useful ratio, drawing on graph paper (the discharge and BOD loading with time), Calculations of peak, average, and Minimum Flow [10 hr] Concept of design criteria, hydraulic retention time, horizontal velocity, and settling velocity. [5 hr] Surface loading rate, weir loading rate, organic loading, Hydraulic loading, volumetric loading. [5 hr] Food to microorganism ratio, Calculation of Mean cell residence time with or without recycling, and recycle ratio. [5 hr] Reactions and reactors (Zero order, first order, second order), concept of reactions, temperature effect on reaction constant. [5] Types of reactors (CFSTR, Plug-Flow, CMBR, FBR, PBR, SBR). [10 hr] General procedure for design calculations, objective, types of treatment units, and sizing of units. [5 hr]

	Design of sump and pump wells of pumping stations, design of approach channel. [5 hr] Design of equalization basins [5] Design of screen chambers and grit chambers. [5 hr] Design of primary and secondary sedimentation tanks. [5 hr] Biological treatment of wastewater aerobics processes, classification, determination of Bio-Kinetic coefficients without recycling, and with recycling.[5 hr] Suspended growth units and the activated sludge process. Classification of trickling filter, and design equations. [5 hr] Anaerobic biological wastewater treatment unit. [5 hr]
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Innovative teaching strategies for wastewater treatment that will help students learn the basics of how the process works: Engage Students with Interactive Models (For example, educators can use physical wastewater treatment plant models to demonstrate the treatment process's different stages. Students can interact with the models and observe the wastewater flow. Make the Topic easy with Video, Infuse Technology into Lessons (for example, educators can use videos and animations to demonstrate the different stages of the treatment process and show the equipment used). Inspire Students Through Career Exploration Educators can help students understand the importance of wastewater treatment and inspire them to pursue a career in the field. Speakers from local wastewater treatment facilities can also be invited to speak to students and share their experiences during field visits. Connect Topic to Real-World Applications: encourage students to research and report on current issues in wastewater treatment, such as emerging contaminants and the impacts of climate change on water quality. Wastewater treatment is a vital process that protects our environment and public health. By incorporating creative and engaging teaching methods and resources like a laboratory, educators can make learning about wastewater treatment more enjoyable, accessible, and inspiring for their students. Classes will be supplemented with field trips

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem)	90	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6

الحمل الدراسي المنتظم للطالب خلال الفصل			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	60	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (20)	5, 12	LO # 3,4,5,6 and 7
	Assignments	2	10% (10)	4, 6	LO #1,2,3, 4 and 5
	project / Lab.	1	5% (5)	Continuous	All
	Report	1	5% (5)	13	LO # 6, 7 and 8
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-6
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	المفردات المعطاة
Week 1	Fundamentals, introduction to wastewater treatment, types of wastewater, concept of treatment, treatment methods, unit operation, unit process.
Week 2	Selection of treatment systems, functions of treatment plant unit, concept of (preliminary treatment system, primary treatment, secondary treatment and tertiary treatment).
Week 3	Strength and characteristics of waste water, concept of mass load, Variation in Mass loading, wastewater flow rate and their fluctuation, Daily variation, seasonal variation, useful ratio, draw the discharge, BOD loading with time.
Week 4	Concept of design criteria, hydraulic retention time, horizontal velocity, Settling velocity. Surface loading rate, weir loading rate, organic loading, Hydraulic loading, volumetric loading, and hydraulic flow diagram. (HW.)
Week 5	Food to microorganism ratio, Calculation of Mean cell residence time with or without recycle, recycle ration. (Quiz)
Week 6	Reactions and reactors (Zero order, first order, second order), concept of reactions, temperature effect on reaction constant. (HW.)
Week 7	Midterm exam

Week 8	Types of reactors (CFSTR, Plug-Flow, CMBR, FBR, PBR, SBR).
Week 9	General procedure for design calculations, objective, types of treatment units. Design of sump and pump wells of pumping stations, design of approach channel.
Week 10	Design of equalization basins
Week 11	Design of screen chamber, grit chambers
Week 12	Design of primary and secondary sedimentation tanks .(Quiz)
Week 13	Biological treatment of waste water aerobic processes, classification. (report)
Week 14	Suspended growth units, activated sludge process. Classification of trickling filter, design equations.
Week 15	Anaerobic biological wastewater treatment unit.
Week 16	Final exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Introduction
Week 2	Experimental to Calculate of flow rates and their fluctuations 1
Week 3	Experimental to Calculate of flow rates and their fluctuations 2
Week 4	Experimental Physical treatment (Screen chamber) (in the field)
Week 5	Experimental chemical treatment by using some coagulants (Jar Test)
Week 6	Experimental of Biological treatment (aerobic reactor 1)
Week 7	Experimental of Biological treatment (aerobic reactor 2)
Week 8	Experimental of Biological treatment (duckweeds – Lemna gibba) (in the field)
Week 9	Estimation of sludge volume index
Week 10	Discussions

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the
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		Library?
Required Texts	Water and Wastewater Treatment and Disposal by Metcalf and Eddy	No
Recommended Texts	Water Supply and Sewerage System by Mc Ghee and Steel	No
Websites	https://ocw.mit.edu/courses/1-85-water-and-wastewater-treatment-engineering-spring-2006/pages/lecture-notes/	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	تكاليف بيئية		Module Delivery
Module Type			☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code			
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	4	Semester of Delivery	1
Administering Department	Type Dept. Code	College	Type College Code
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	Ph.D.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	01/06/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None		Semester
Co-requisites module	None		Semester

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. تزويد الطلبة بالمعارف والمهارات الأساسية المتعلقة بمفهوم التكاليف البيئية وتصنيفاتها المختلفة داخل المنشآت والمشاريع البيئية والتعليمية والصناعية. 2. تمكين الطالب من فهم واستخدام أساليب قياس وتحليل التكاليف البيئية (الداخلية والخارجية) وربطها بالأداء البيئي واستراتيجيات الاستدامة. 3. تدريب الطلبة على كيفية إدماج البعد البيئي والتكاليف البيئية في اتخاذ القرارات الإدارية والتكنولوجية، بما يساهم في الحد من التلوث وترشيد استخدام الموارد. 4. إكساب الطلبة القدرة على تقييم دور المحاسبة عن التكاليف البيئية وإعداد التقارير البيئية للمؤسسات والشركات.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. تعريف وتفسير المفاهيم الأساسية للتكاليف البيئية والمحاسبة البيئية والإدارة المالية البيئية. 2. تصنيف التكاليف البيئية (تكاليف المنع والوقاية، التقييم والتدقيق، الفشل الداخلي، والفشل الخارجي). 3. قياس التكاليف البيئية الخارجية (External Costs) وتحديد أثر التلوث والأنشطة الصناعية على المجتمع والبيئة. 4. تطبيق تقنيات حساب التكاليف البيئية مثل: حساب التكاليف على أساس النشاط البيئي (ABC) وحساب تكاليف دورة الحياة (Life Cycle Costing - LCC). 5. تحليل وتفسير التقارير المالية البيئية واستخدام معلومات التكاليف البيئية في تقييم الأثر البيئي لاتخاذ قرارات التكنولوجيا الخضراء. 6. اقتراح حلول تقنية واقتصادية للتقليل من الهدر والتكاليف البيئية في المنشآت الصناعية والخدمية.
Indicative Contents المحتويات الإرشادية	• المقدمة والإطار المفاهيمي للتكاليف البيئية (9 ساعات): المفهوم، الأهمية، العلاقة بين تقانات البيئة والاقتصاد البيئي، التحديات البيئية المعاصرة. • تصنيف وهيكلية التكاليف البيئية (12 ساعة): تكاليف الوقاية، تكاليف التقييم والقياس، تكاليف الفشل الداخلي (إدارة الفضلات والنفايات)، وتكاليف الفشل الخارجي (التعويضات والأضرار). • قياس وتحليل التكاليف البيئية (15 ساعة): أساليب القياس المباشر وغير المباشر، التكاليف البيئية المستترة، والتكاليف الخارجية (Externalities) وتقييم الأضرار البيئية. • تقنيات وأدوات إدارة التكاليف البيئية (12 ساعة): تكاليف دورة الحياة (LCC)، المحاسبة عن التكاليف على أساس النشاط البيئي (Environmental ABC)، والتدقيق البيئي. • التكاليف البيئية واتخاذ القرارات والاستدامة (12 ساعة): تحليل المنافع والتكاليف البيئية (CBA)، الاستثمار في تقانات التلوث النظيف، والتقارير والإفصاح عن التكاليف البيئية.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	يتم تقديم هذه المادة النظرية من خلال المحاضرات التفاعلية، دراسات الحالة العلمية (Case Studies) لمشاريع وتحديات بيئية واقعية، والمناقشات الجماعية. تركز استراتيجيات التدريس على تحفيز التفكير النقدي لدى الطلبة وربط التقانات البيئية بالجانب المالي والاقتصادي. يتم تقييم التعلم من خلال الاختبارات السريعة (Quizzes)، الواجبات المنزلية، بالإضافة إلى الامتحانات الفصلية والنهائية.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	15% (15)	3, 12	LO #1, 2, 4, 5 and 7
	Assignments	3	15% (15)	Continuous	All
	Projects / Lab.				
	Report	1	10% (10)	13	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	مقدمة في التكاليف البيئية: المفاهيم، الأنشطة البيئية وعلاقتها بتقانات البيئة.
Week 2	المحاسبة البيئية والإدارة المالية البيئية: الأهداف والأهمية للمؤسسات والمصانع.
Week 3	تكاليف المنع والوقاية البيئية. (Prevention Costs)
Week 4	تكاليف التقييم والقياس والتدقيق البيئي. (Appraisal Costs)
Week 5	تكاليف الفشل الداخلي وإدارة الفضلات. (Internal Failure Costs)
Week 6	تكاليف الفشل الخارجي والتعويضات البيئية. (External Failure Costs)
Week 7	قياس التكاليف البيئية الخارجية (Environmental Externalities) والأضرار الاجتماعية والبيئية.
Week 8	اختبار نصف الفصل (Midterm Exam)
Week 9	أساليب تقييم التكاليف البيئية المستترة والمستقبلية. (Hidden & Contingent Environmental Costs)
Week 10	تطبيق نظام التكاليف على أساس النشاط البيئي. (Environmental Activity-Based Costing - EABC)

Week 11	حساب تكاليف دورة حياة المنتج والتقنيات البيئية. (Life Cycle Costing - LCC)
Week 12	تحليل المنافع والتكاليف البيئية (Environmental Cost-Benefit Analysis) لاختيار التقنيات الخضراء.
Week 13	دور التكاليف البيئية في اتخاذ القرارات الاستثمارية والحد من التلوث وإدارة النفايات.
Week 14	التقارير والإفصاح المالي البيئي (Environmental Financial Reporting) وتطبيقات الاستدامة.
Week 15	دراسة حالة شاملة: (Case Study) تقييم التكاليف البيئية لمنشأة صناعية/خدمية وطرق معالجتها.
Week 16	الامتحان النهائي (Final Exam)

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Schaltegger, S., Bennett, M., Burritt, R. L., & Jasch, C. (Eds.). (2008). <i>Environmental Management Accounting for Cleaner Production</i> . Springer.	
Recommended Texts	• Schaltegger, S., & Burritt, R. (2017). <i>Contemporary Environmental Accounting: Issues, Concepts and Practice</i> . Routledge.	
Websites	• IFAC - Environmental Management Accounting Statements • United Nations Division for Sustainable Development (UNSD) - EMA Guidelines	

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جداً	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Professional Ethics		Module Delivery
Module Type		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code			
ECTS Credits			
SWL (hr./sem.)			
Module Level	4	Semester of Delivery	1
Administering Department	Environmental Technologies	College	Environmental Sciences
Module Leader	Dr. Mayada Ahmed Al-Taii	e-mail	maysbio55@uomosul.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date	2026-2027	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	The course aims to prepare students to act responsibly and with integrity in laboratories, companies, and the labor market after graduation. It also aims to develop their abilities to make sound ethical decisions in the work environment, laboratory, and scientific research, to recognize the rights and duties of workers in scientific fields, to apply the principles of integrity, honesty, and responsibility in professional practice, to understand the importance of occupational and environmental safety, and to promote respect for colleagues, teamwork, and diversity in the work environment.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Explaining the fundamental concepts of professional ethics. 2. Identifying the ethical principles associated with scientific professions. 3. Evaluating professional conduct in real-life situations. 4. Communicating and discussing professionally. 5. Taking professional responsibility and adhering to occupational and environmental safety and scientific integrity.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The suggested teaching methods include lecturing, discussion, case-based learning, daily and term tests, group discussions, analysis of ethical problems, as well as student presentations and discussions.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (hr./sem.) الحمل الدراسي المنتظم للطالب خلال الفصل		Structured SWL (hr./w) الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (hr./sem.) الحمل الدراسي غير المنتظم للطالب خلال الفصل		Unstructured SWL (hr./w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (hr./sem.) الحمل الدراسي الكلي للطالب خلال الفصل			

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative	Quizzes	2	20% (10)	5, 11	LO #

assessment	Assignments	2	10% (5)	6, 13	LO #
	Lab.	-----	-----	-----	-----
	Report	1	10% (10)		
Summative assessment	Midterm Exam	1 hr.	10% (10)	7	LO #
	Final Exam	3hr.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Ethics and Professional Ethics
Week 2	Work, Profession, and Work Conduct
Week 3	Ethics of Scientific Professions
Week 4	Professional and ethical responsibility
Week 5	Professional conduct in the workplace
Week 6	The environmental researcher's responsibility towards the environment and society
Week 7	Midterm Exam - Ethics of fieldwork and sample collection
Week 8	Data Analysis and Management
Week 9	Occupational and Environmental Safety
Week 10	Academic and Scientific Integrity
Week 11	Conflict of Interest
Week 12	Ethical Problem Identification and Decision Making
Week 13	Patterns of Unethical Behavior in the Profession (Bribery and Fraud)
Week 14	Administrative Corruption
Week 15	Case Studies from Scientific Fields
Week 16	Final Exam

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		
Recommended Texts	A text book of Professional Ethics, Manu et.al (2024)	NO , network
Websites		

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A –Excellent	امتياز	90 – 100	Outstanding Performance
	B - Very Good	جيد جدا	80 – 89	Above average with some errors
	C –Good	جيد	70 – 79	Sound work with notable errors
	D –Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E –Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information			
Module Title	Desertification and land reclamation		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☒ Practical ☒ Seminar
Module Code	ENVT337		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	4	Semester of Delivery	1
Administering Department	Type Dept. Code	College	Type College Code
Module Leader	Abdul SattarJubairZaben Ahmed Abdel RazzaqKhadr		e-mail E-mail
Module Leader's Acad. Title	Assistant professor Assistant teacher	Module Leader's Qualification	Ph.D. M.Sc.
Module Tutor	Name (if available)	e-mail	E-mail :sattarjubair@uomosul.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail :Ahmed85@uomosul.edu.iq
Scientific Committee Approval Date	30/06/2025	Version Number	1.0

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. Introduce students to the concepts of land degradation and its various forms, such as salinity, erosion, and physical and chemical degradation, while understanding their associated environmental and human causes, especially in arid and semi-arid environments. 2. Enable students to analyze land reclamation techniques using simplified environmental and engineering methods, such as improving soil physical properties, irrigation and drainage management, using resilient plants, and desertification and erosion control techniques. 3. Stimulate students' critical thinking by studying real-life local and global cases and evaluating the environmental, economic, and social impacts of land reclamation operations in areas such as Nineveh, the Marshes, the Delta, and the Netherlands.
Module Learning Outcomes	1. Analyze the causes of land degradation (physical, chemical, biological) and explain their environmental mechanisms in arid and semi-arid environments. 2. Apply the basic concepts of land reclamation in agricultural and environmental contexts, including selecting appropriate techniques for soil improvement, water management, and vegetation cover. 3. Identify the characteristics of degraded lands (saline, alkaline, wet, gypsum) and determine the appropriate technical response for their reclamation using simplified environmental and field methodologies.
Indicative Contents	The guiding content includes the following: 1. The course covers the basic theoretical concepts of land degradation and land reclamation in arid and semi-arid environments, with a focus on the physical and chemical aspects of soil. 2. Case studies from Iraq and around the world demonstrate land reclamation applications in saline, alkaline, and swampy soils. 3. Develop students' environmental awareness to select sustainable, environmentally and economically appropriate solutions.

Learning and Teaching Strategies

Strategies	1. Interactive lectures supported by real-life examples from local and international reclamation projects, using educational media. 2. Analysis of applied case studies to evaluate environmental and engineering reclamation techniques and discuss their effectiveness. 3. Problem-based learning and scientific discussion, to develop critical thinking skills by solving mathematical problems and comparing technical alternatives.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	80	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	70	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	1	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Desertification
Week 2	Effects of Desertification on Soil, Water, and Vegetation
Week 3	Sustainable Management of Desertification
Week 4	Introduction to Land Reclamation - Basic Concepts and Engineering Applications
Week 5	Soil Properties and Improvement for Reclamation
Week 6	Surface Water Management and Soil Structure Improvement to Ensure the Sustainability of Reclaimed Land
Week 7	Midterm Exam
Week 8	Environmental Civil Engineering in Land Reclamation
Week 9	Applications of Modern Technologies in Land Reclamation
Week 10	Impacts of Climate Change on Land Reclamation
Week 11	Global Case Studies in Land Reclamation
Week 12	Recycling Reclaimed Materials to Enhance Environmental Cycles
Week 13	Developing Smart Environmental Monitoring Systems to Assess the Sustainability of Reclaimed Land
Week 14	Assessing the Environmental Impact of Reclamation Projects Using Digital Models
Week 15	Final exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Reddy, S. R. (2011). Land Reclamation: Principles and Practice. Scientific Publishers. Al-Khudairi, H. A., & Al-Taiee, T. M. (2020). Evaluating salinity and drainage efficiency in reclamation of Iraqi soils. Iraqi Journal of Agricultural Sciences, 51(2), 352–366. Al-Mashhadani, S. I. (2021). Desertification dynamics in Western Iraq using MODIS and Landsat data. Arabian Journal of Geosciences, 14(11), 1207. FAO. (2016). Guidelines for Salinity Assessment, Mitigation and Adaptation Using Remote Sensing and GIS. Food and Agriculture Organization of the United Nations.	Yes
Recommended Texts	Kirkham, M. B. (2014). <i>Principles of Soil and Plant Water Relations</i> (2nd ed.). Academic Press. Waller, P., & Yitayew, M. (2016). Irrigation and Drainage Engineering. Springer.	No
Websites	https://www.fao.org/soils-portal/soil-management/management-of-some-problem-soils/saline-soils/en/ https://www.nrcs.usda.gov/resources/guides-and-instructions/saline-and-sodic-soils	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Environmental Management & Legislation		Module Delivery
Module Type			☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code			
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	4	Semester of Delivery	2
Administering Department	Type Dept. Code	College	Type College Code
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	Ph.D.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	01/06/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None		Semester
Co-requisites module	None		Semester

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Provide students with advanced knowledge and practical skills regarding modern environmental management frameworks and corporate environmental governance. 2. Understand and apply national, regional, and international environmental legislation, regulatory frameworks, and compliance standards for pollution control. 3. Train students on implementing internationally recognized Environmental Management Systems (such as ISO 14001) and conducting environmental auditing. 4. Equip students with the ability to analyze environmental policies and integrate technological solutions with environmental regulations.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Explain fundamental concepts of environmental management, environmental policy, and legal regulations. 2. Analyze national environmental laws regulating air quality, water resources, soil protection, and hazardous waste management. 3. Apply ISO 14001 requirements and design environmental policies for industrial and developmental projects. 4. Identify core legal principles such as the Polluter Pays Principle, Precautionary Principle, and Sustainable Development goals. 5. Evaluate environmental compliance through environmental auditing procedures and regulatory inspections. 6. Propose administrative and legal solutions for environmental challenges and prepare Environmental Management Plans (EMP).
Indicative Contents المحتويات الإرشادية	1. Introduction to Environmental Management & Legislation (9 hours): Core concepts, evolution of environmental management, environmental policy frameworks, and core legal principles. 2. National & Regional Environmental Law (12 hours): National statutes, emission standards, environmental protection acts, and regulatory permits. 3. International Environmental Agreements (12 hours): Climate treaties (Kyoto Protocol, Paris Agreement), waste management conventions (Basel, Stockholm), and global environmental governance. 4. Environmental Management Systems (EMS) & Audit (15 hours): ISO 14000 family, ISO 14001 implementation, environmental auditing techniques, and performance indicators (EPI). 5. Policy Tools & Environmental Compliance (12 hours): Environmental Management Plans (EMP), regulatory permitting, inspection mechanisms, corporate social responsibility (CSR), and sustainability.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	This theoretical module is delivered through interactive lectures, classroom discussions, and case studies examining real-world compliance and EMS implementation in industrial sectors. The teaching strategy emphasizes critical analysis of legal frameworks, international treaties, and ISO 14001 standards. Student learning is assessed through quizzes, individual/group assignments, analytical reports, midterm, and final examinations.
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Student Workload (SWL)			
الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	15% (15)	3, 12	LO #1, 2, 4, 5 and 7
	Assignments	3	15% (15)	Continuous	All
	Projects / Lab.				
	Report	1	10% (10)	13	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Environmental Management, Policy Frameworks, and Environmental Technologies.
Week 2	Core Legal Principles (Polluter Pays Principle, Precautionary Principle, Strict Liability).
Week 3	National Environmental Legislation and Statutes for Air, Water, and Soil Protection.
Week 4	Regulations and Directives for Solid, Hazardous Waste, and Chemical Management.
Week 5	International Climate Change Agreements (UNFCCC, Kyoto Protocol, Paris Agreement).
Week 6	International Environmental Conventions (Basel Convention, Stockholm, CITES).
Week 7	Environmental Management System: ISO 14001 Requirements, Framework, and Execution.
Week 8	Midterm Examination
Week 9	Designing and Implementing Environmental Policies in Industrial and Service Facilities.

Week 10	Environmental Auditing: Methodologies, Types, Protocol, and Regulatory Compliance.
Week 11	Environmental Performance Evaluation (EPE) and Key Performance Indicators (EPis).
Week 12	Development of Environmental Management Plans (EMP) for Development Projects.
Week 13	Environmental Permitting, Licensing Mechanisms, and Regulatory Inspection Procedures.
Week 14	Environmental Governance, Corporate Social Responsibility (CSR), and Sustainability Integration.
Week 15	Comprehensive Case Study: Environmental Management and Legal Compliance Assessment.
Week 16	Final Examination

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	• Barrow, C. J. (2006). Environmental Management for Sustainable Development. Routledge. • Bell, S., & McGillivray, D. (2017). Environmental Law. Oxford University Press.	
Recommended Texts	• Sheldon, C., & Yoxon, M. (2012). Environmental Management Systems: A Step-by-Step Guide to ISO 14001. Earthscan.	
Websites	• ISO official website (ISO 14001 Standards) • UNEP - United Nations Environment Programme (Environmental Law & Governance)	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Environmental Nanotechnology		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar
Module Code	ENVT342		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	4 (Undergraduate)	Semester of Delivery	2
Administering Department	Department of Environmental Technologies	College	College of Environmental Sciences
Module Leader	Assist.Prof.Dr.Eman A.M. Al-jawadi	e-mail	emanaljawadi@uomosul.edu.iq
Module Leader's Acad. Title	Ass.st.Prof.	Module Leader's Qualification	Ph.D./Chemistry Science
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	16/5/2026	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Chemistry 1+Chemistry 2	Semester	2
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The course aims to enable students to: • Core Fundamentals: Introduce the history, basic concepts, and unique size-dependent physicochemical properties of environmental nanomaterials. • Synthesis & Diagnostics: Equip students with specialized scientific knowledge regarding green synthesis pathways and standard laboratory characterization tools (microscopic and spectroscopic techniques). • Advanced Remediation: Demonstrate the technical applications of nanomaterials and nanofiltration membranes in water purification, soil remediation, and air filtration. • Monitoring & Biosecurity: Explore the use of advanced environmental nanosensors and NEMS for tracking pollutants, while evaluating nanomaterial ecotoxicology, environmental fate, and cellular toxicity mechanisms.
Module Learning Outcomes	Module Learning Outcomes (CLOs) Upon successful completion of this course, students will be able to: • CLO 1: Explain advanced physicochemical modifications and quantum confinement phenomena that occur at the nanoscale for various engineered nanoparticles. • CLO 2: Differentiate between top-down, bottom-up, and green synthesis methods, and interpret analytical data from microscopic (SEM, TEM) and spectroscopic (XRD, FTIR) tools. • CLO 3: Apply nano-adsorbents, photocatalysts, and nanofiltration membranes to design solutions for contaminated water, soil, and air matrices. • CLO 4: Evaluate the operational mechanics of environmental nanosensors (NEMS), analyze bioaccumulation pathways, and estimate cellular ecotoxicity risks (ROS).
Learning and Teaching Strategies مخرجات التعلم للمادة الدراسية	Contribution to Program Outcomes (PLOs) This module contributes to achieving the general program outcomes of Environmental Technologies as follows: • Acquire Specialist Knowledge: Provides seniors with specialized nanotechnological knowledge tailored specifically to trace pollutants remediation and monitoring. • Environmental Solutions Analysis: Enhances capacity to interpret structural characterization data to execute professional environmental specialist practices under real-world constraints. • Modern Techniques Application: Enables students to deploy green-synthesized nanomaterials and advanced NEMS to address contemporary biosecurity challenges.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Strategies: The module utilizes a student-centered pedagogical framework designed for theoretical-tutorial delivery. The implementation includes interactive lectures supported by multimedia to simplify quantum properties, practical case studies to analyze microscopic/spectroscopic charts (XRD, SEM, TEM), and student-led evaluation seminars (Week 13) to review green energy, ecotoxicity, and sustainable food applications using problem-based learning (PBL).

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	70	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	14
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	80	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	14

Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	150
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Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10 Marks)	Weeks 4, 11	CLO # 1, 2
	Assignments	2	6% (6 Marks)	Weeks 3, 10	CLO # 2, 3
	Tutorial / Lab.	Continuous	10% (10 Marks)	Weekly	All (CLO 1 - 4)
	Report	1	10% (10 Marks)	Week 12	CLO # 3, 4
	Seminar	1	4% (4 Marks)	Week 13	All (CLO 1 - 4)
Summative assessment	2 hr	10% (10 Marks)	Week 8	CLO # 1, 2, 3	2 hr
	3 hr	50% (50 Marks)	Week 14	All (CLO 1 - 4)	3 hr
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Environmental Nanotechnology: History, Concepts, and Environmental Relevance.
Week 2	Physicochemical Properties of Environmental Nanomaterials: Size Confinement, Shape, and Surface Area.
Week 3	Types and Environmental Uses of Carbon-Based Nanomaterials: Carbon Nanotubes (CNTs), Graphene, and Fullerenes.
Week 4	Metal and Metal-Oxide Nanoparticles in Nature: Quantum Dots, Titanium Dioxide (TiO ₂) and Nano-Zero Valent Iron (nZVI).
Week 5	Synthesis of Environmental Nanomaterials: Top-Down vs. Bottom-Up and Green Synthesis via Microbes/Plants.
Week 6	Characterization Tools for Environmental Matrices 1: Microscopic Techniques (SEM, TEM, AFM).
Week 7	Characterization Tools for Environmental Matrices 2: Spectroscopic Techniques (XRD, UV-Vis, FTIR).
Week 8	Midterm Examination (Theoretical comprehensive 2-hour exam)
Week 9	Nanotechnology in Water Treatment: Nano-adsorbents, Nanofiltration Membranes, and Photocatalytic Desalination.
Week 10	Nanotechnology in Air and Soil Remediation: Soil Contaminant Degradation and Nano-catalytic Air Filters.

Week 11	Environmental Nanosensors and NEMS: Swift Chemical, Biological, and Gas Pollutant Detection.
Week 12	Ecotoxicology of Nanomaterials: Bioaccumulation, Fate, Transport, and Cellular Toxicity Mechanisms (ROS).
Week 13	Nanotechnology in Green Energy and Sustainable Food Applications (Student Seminars and Case Studies Presentation).
Week 14	Final Examination (Comprehensive Theoretical Examination)

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	.Mark R. Wiesner, Jean-Yves Bottero, Environmental Nanotechnology: Applications and Impacts of Nanomaterials, 2nd Edition, McGraw Hill, 2025. .S. G. Chandru, Ecotoxicology and Fate of Environmental Nanomaterials, Academic Press, 2025.	
Recommended Texts	.Green Synthesis of Nanomaterials for Environmental Remediation: Microbes and Plants Methods, Springer Nature, 2025. . Charles P. Poole Jr., Frank J. Owens, Introduction to Nanotechnology: Modern Environmental Perspectives, Revised Edition, John Wiley & Sons, 2025.	
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	Management and Sludge Treatment		Module Delivery	
Module Type	Core		☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☒ Practical ☒ Seminar	
Module Code	ENVT340			
ECTS Credits	5			
SWL (hr/sem)	125			
Module Level	4	Semester of Delivery		2
Administering Department	Environmental Technologies	College	Environmental sciences	
Module Leader	Rasha Khalid Sabri		e-mail	rashamhemid@uomosul.edu.iq
Module Leader's Acad. Title	Assistant Professor	Module Leader's Qualification	PhD.	
Module Tutor	Roua Mudhaffar Yunus		e-mail	roaoyouns@uomosul.edu.iq
Peer Reviewer Name		e-mail		
Scientific Committee Approval Date	07/06/2026	Version Number	1.0	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Wastewater treatment	Semester	1
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To introduce students to the sources and types of sludge generated from wastewater treatment processes. 2. To understand the physical, chemical, and biological characteristics of sludge. 3. To explore the processes used in sludge stabilization, dewatering, drying, and storage. 4. To provide safe and environmentally sound methods for sludge disposal and reuse. 5. To develop students' skills in analyzing and designing sludge treatment units. 6. To prepare students for operating and managing integrated wastewater treatment plants, including sludge treatment.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On successful completion of this module, students will be able to: 1. Identify the sources, classification, composition, and the physical, chemical, and biological characteristics of sludge produced in wastewater treatment processes. 2. Describe sludge treatment and management processes, including thickening, stabilization, dewatering, drying, incineration, storage, disposal, and reuse. 3. Apply engineering design and operational criteria to sludge treatment units, including thickening, digestion, dewatering, drying, and storage. 4. Consider alternatives for sludge management with respect to environmental, health, safety, regulatory, and sustainability issues. Land application, composting, energy recovery, laboratory testing, and technical reporting.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Introduction to sludge: sources and classification. [5 hr] Physical and chemical characteristics of sludge. [5 hr] Biological characteristics and pathogen content. [10 hr] Sludge thickening methods (gravity, flotation, centrifugation). [10 hr] Sludge stabilization (aerobic and anaerobic digestion). [10 hr] Sludge dewatering (drying beds, belt filters, centrifuges). [10 hr] Sludge drying and incineration techniques. [10 hr] Sludge reuse in agriculture and land applications. [10 hr] Environmental and health impacts of sludge management. [10 hr] Legal and regulatory frameworks for sludge disposal. [10 hr] Design of sludge treatment units (exercise + quiz). [5 hr] SVI (Sludge Volume Index) measurement & coagulant dosage. [10 hr] Case studies in sludge treatment technologies. [10 hr] Project presentations and review. [10 hr]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	To effectively teach the principles of sludge management and treatment, the following strategies will be adopted: • Interactive Lectures: Use of presentations, videos, and visual aids to explain sludge treatment processes and unit operations. • Hands-on Laboratory Sessions: Practical experiments to measure sludge characteristics and evaluate treatment methods. • Field Visits: Organizing site visits to wastewater treatment plants with sludge handling units to observe real-world applications. • Problem-Based Learning: Students will be engaged in solving real engineering problems related to sludge generation, treatment, and disposal. • Design Projects: Students will complete small-scale projects that include designing sludge thickening or stabilization units. • Group Discussions and Seminars: Encouraging teamwork and exchange of ideas through assigned readings, research presentations, and debates on sustainable sludge management. • Technology Integration: Use of simulation tools and software (e.g., spreadsheets, modeling tools) to enhance understanding of sludge treatment design and performance evaluation
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	90	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	35	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (20)	5, 12	LO #2, 3 and 4
	Assignments	2	10% (10)	4, 6	LO #1, 2 and 3
	Project / Practical	1	5% (5)	Continuous	LO #1, 2, 3 and 4
	Report	1	5% (5)	13	LO #4
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO #1, 2 and 3
	Final Exam	3 hr	50% (50)	16	LO #1, 2, 3 and 4
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	المفردات المعطاة
Week 1	Introduction to sludge: sources and classification.
Week 2	Physical and chemical characteristics of sludge.
Week 3	Biological characteristics and pathogen content.
Week 4	Sludge thickening methods (gravity, flotation, centrifugation). (HW.)
Week 5	Sludge stabilization (aerobic and anaerobic digestion). (Quiz)
Week 6	Sludge dewatering (drying beds, belt filters, centrifuges). (HW.)
Week 7	Midterm Exam
Week 8	Sludge drying and incineration techniques.
Week 9	Sludge reuse in agriculture and land applications.
Week 10	Environmental and health impacts of sludge management.
Week 11	Legal and regulatory frameworks for sludge disposal.
Week 12	Design of sludge treatment units (exercise + quiz). (Quiz)
Week 13	SVI (Sludge Volume Index) measurement & coagulant dosage. (Report)
Week 14	Case studies in sludge treatment technologies.
Week 15	Project presentations and review.
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Water and Wastewater Treatment and Disposal by Metcalf and Eddy	No
Recommended Texts	<i>Wastewater Engineering: Treatment and Reuse,</i> Tchobanoglous et al.2003 Chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ptabdata.blob.core.windows.net/files/2017/IPR2017-01468/v22_FWS1016%20-%20Metcalf.pdf	No
Websites	https://ocw.mit.edu/courses/1-85-water-and-wastewater-treatment-engineering-spring-2006/pages/lecture-notes/	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

Module Information			
Module Title	Environmental Impact Assessment		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar
Module Code	ENVT336		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	4	Semester of Delivery	2
Administering Department	Environmental Technology	College	Environmental Sciences
Module Leader	Mohammed Fakhraldeen Ahmed	e-mail	milhebi@uomosul.edu.iq
Module Leader's Acad. Title	Assistant professor	Module Leader's Qualification	MSc.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date	1/ 6 /2026	Version Number	2.0

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Introduction to the requirements and frameworks of Environmental Impact Assessment (EIA) and its reporting structure. 2. Explanation of environmental classification methodologies and matrices for different impacts. 3. Enablement of a theoretical understanding of occupational hazards and the calculation of toxic and carcinogenic doses. 4. Interpretation of exposure indicators and clinical data for projects. 5. Development of critical thinking skills for comparing alternatives and making sound decisions for proposed projects.
Module Learning Outcomes	1. Explains the requirements and structure of environmental impact assessment and project reporting. 2. Uses environmental assessment methods and matrices to determine the short- and long-term impacts of implemented and proposed projects. 3. Analyzes environmental and occupational hazards and calculates the impact of carcinogenic and non-carcinogenic doses. 4. Interprets risk indicators, exposure data, and clinical data to apply project quality procedures.
Indicative Contents	Chapter 1: Introduction to Environmental Impact Assessment (EIA) Terminology, EIA Requirements, and Environmental Management Responsibilities (6 hours) Chapter 2: Types of Environmental Impacts and Environmental Classification of Projects (6 hours) Chapter 3: General Structure of EIA Processes and Steps, Scope Examination, and Impact Analysis Checklists (16 hours) Chapter 4: Short-term and long-term environmental impacts, visual and digital project evaluation (6 hours) Chapter 5: Methods of presenting environmental impact assessments, the direct approach, the composite map method, the checklist review method, the matrix method (14 hours) Chapter 6: Explanation of examples of environmental impact reports (8 hours) Chapter 7: Introduction to risk assessment and its components (risk diagnosis, responsible dose assessment, risk characteristics, risk management) (8 hours) Chapter 8: Relative, contributing, and resulting risks, clinical data, evidence-weighted classification of potential carcinogenicity, efficacy constant for cancer cases, occupational risk (10 hours) Chapter 9: Source dose for non-carcinogenic effects, resulting risk, risk index, UV exposure index (16 hours)

Learning and Teaching Strategies	
Strategies	The main strategy to be adopted in delivering this unit is to encourage students to participate in exercises, while simultaneously improving and expanding their critical thinking skills. This will be achieved through interactive classes and educational programs, by completing exercises in writing about the environmental impacts of various projects, and by conducting field visits to projects operating in Mosul to learn about their environmental effects.

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	15% (15)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	15% (15)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.				
	Report	1	10% (10)	13	LO # 7,12 and 14
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Student Workload (SWL)			
Structured SWL (h/sem)	90	Structured SWL (h/w)	6.0
Unstructured SWL (h/sem)	60	Unstructured SWL (h/w)	4.0
Total SWL (h/sem)	150		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Definition of environmental impact vocabulary from environmental impact assessment requirements, environmental management duties.
Week 2	Types of environmental impacts, environmental classification of projects.
Week 3	General structure of environmental impact assessment processes and steps, scope examination
Week 4	Impact analysis. Checklists. Daily exam.
Week 5	Short-term and long-term environmental impacts, visual and digital evaluation of projects, methods of presenting environmental impact assessment
Week 6	Direct method, compound map method, list review method, matrix method
Week 7	Mid-year exam
Week 8	Definition of risk assessment and its sections (risk diagnosis, responsible dose assessment, risk characteristics, risk management)
Week 9	Relative risk, Attributable Risk , and Odd risk, clinical data
Week 10	Weight of evidence classification for carcinogenic potential
Week 11	Potency factor for carcinogens, An Occupational Exposure, Daily Exam.
Week 12	The reference Dose for Non-carcinogenic Effects , Hazard Index.
Week 13	Hazard Index, UV Exposure Index
Week 14	Solve various examples
Week 15	General review of all chapters

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	1. Environmental engineering of science . 2. introduction to environmental engineering and science (Gillbert M. Masters)1988.	No
Recommend ed Texts	1) Executive Instructions for Environmental Impact Assessment in Syria - Publications of the General Authority for Environmental Affairs / Damascus / 2008. 2) The Jordanian Environment Observatory - Prepared the Jordanian Environment Alternative and is a guide for environmental licensing and environmental impact assessment.	No
Websites		



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Environmental Biotechnology		Module Delivery
Module Type	Core		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar
Module Code	ENVT		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UG 4	Semester of Delivery	
Administering Department	Environmental Technologies	College	Environmental sciences
Module Leader	Dr. Mayada Ahmed AL-Taii Maan Hashim Mahmood	e-mail	maysbio55@uomosul.edu.iq maanhashim@uomosul.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D
Module Tutor	Diana Nooraldine Mustafa Hiba Yonis Abdullah Abdusttar Thanoon	e-mail	Dyasbio86@uomosul.edu.iq abdullah84@uomosul.edu.iq
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date	30/6/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The course aims to provide students with knowledge and understanding of specialized applications related to the biological activity and metabolic capacity of living organisms, including microorganisms and plants, and their molecular biology, to clarify their role in technical fields in solving and avoiding environmental problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The course covers the details of various bioremediations for various environmental pollutants using different types of organisms and the possibility of genetically modifying them to produce strains with high biological capacity, harnessing them to preserve and sustain the environment and ensure the sustainable use of its resources.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	The main strategy adopted in presenting this course is to encourage students to develop the skills of scientific observation and description of phenomena, to read and discuss, while simultaneously enhancing their critical thinking skills. This will be achieved through daily and semester tests, daily discussions, and laboratory experiments.

Student Workload (SWL)			
الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	78	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	72	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	150		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (5)	5, 10	
	Assignments	2	10% (5)	6, 12	
	Lab.	2	10% (5)	3, 10	
	Seminar	1	10% (10)		all
Summative assessment	Midterm Exam	2 hr	10% (10)	7	
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المناهج الاسبوعي النظري	
	Material Covered
Week 1	Biotechnology: Definition and Basic Concepts
Week 2	The Environmental Microorganisms and biofilm
Week 3	Microbial Systems Used for Wastewater Treatment
Week 4	Removal of Domestic, Industrial, and Agricultural Waste
Week 5	Decomposition of Organic Matter, Humus Formation, and Compost Production
Week 6	Bioremediation of Petroleum Pollutants and Inorganic Chemicals
Week 7	Metal Bioleaching from the Environment, Midterm Exam
Week 8	Xenobiotics in the Environment and Methods for Their Removal

Week 9	Energy and Biofuel Production
Week 10	Genetically Modified Organisms (GMOs)
Week 11	Genetic Material: Nucleic Acid Structure and Replication
Week 12	Genetic Material: Protein Synthesis
Week 13	Gene Cloning
Week 14	Applications of Microbiology in Environmental Monitoring
Week 15	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المناهج الاسبوعي للمختبر	
	Material Covered
Week 1	Biosafety in Biotechnology Laboratories
Week 2	Methods for measuring the growth of Microorganisms
Week 3	Microbial Metabolism Tests
Week 4	Methods for Biofilm detection
Week 5	Production of Cellulase by microorganisms
Week 6	Production of Bio-surfactant by bacteria
Week 7	Bioremediation of Petroleum Hydrocarbons by Microorganisms
Week 8	Bioremediation of Heavy Metals by Yeasts
Week 9	Testing Bacterial Resistance to Heavy Metals
Week 10	Biodegradation of Plastics
Week 11	Plasmid Curing
Week 12	Methods for Extracting Nucleic Acids (DNA and RNA)
Week 13	Polymerase Chain Reaction (PCR) (1)
Week 14	Polymerase Chain Reaction (PCR) (2)
Week 15	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Environmental biotechnology : Concepts and Applications by Jordening, H.J. and Winter, J. (2005) John Wiley and Sons.	No

Recommended Texts	Weaver, R.F. (2012). Molecular Biology. 5 th edition, McGraw –Hill, USA.	No
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 – 89	Above average with some errors
	C – Good	جيد	70 – 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 – 69	Fair but with major shortcomings
	E – Sufficient	مقبول	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Research methodology منهجية البحث العلمي		Module Delivery
Module Type	C		☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	ENVT438		
ECTS Credits	3		
SWL (hr/sem)	75		
Module Level	4	Semester of Delivery	1
Administering Department	Environmental Technologies	College	College of Environmental Sciences
Module Leader	Hazim Jumaa Mahmood	e-mail	
Module Leader's Acad. Title	Assistant Professor	Module Leader's Qualification	
Module Tutor	Lecturer Wissam Saeed	e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Introduce students to the fundamental concepts, principles, and terminology of scientific research. 2. Develop students' understanding of the research process, including problem identification, literature review, research design, and ethical considerations. 3. Equip students with the knowledge and practical skills needed to collect, organize, analyze, and interpret research data using appropriate methods and tools. 4. Develop students' ability to formulate research objectives, questions, and hypotheses, and to select appropriate qualitative, quantitative, or mixed research methodologies. 5. Enhance students' academic writing skills through the correct use of scientific citation, referencing, and research report preparation. 6. Foster critical thinking, analytical reasoning, and ethical decision-making in conducting and evaluating scientific research. 7. Prepare students to design and present a research proposal that meets accepted academic and professional standards.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Define the basic concepts and terminology of scientific research and identify the main steps and components of the research process. 2. Explain the different types of scientific research and their fields of application, and discuss the importance of literature review and research ethics. 3. Apply scientific citation and referencing methods in research report writing and use appropriate data collection tools according to the nature of the study. 4. Analyze a research problem, formulate its objectives, questions, or hypotheses, and distinguish among different research methodologies to select the most appropriate one for a study.

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part (A) Foundations of Scientific Research: The module introduces the foundations of scientific research, including its definition, purpose, characteristics, terminology, and the stages of the research process. It examines the major types of research—basic and applied, qualitative, quantitative, and mixed methods—and explores their fields of application. Students also learn how to identify and define research problems, formulate research aims, objectives, research questions, and hypotheses, and select appropriate research designs and methodologies. [14 hrs] Part (B) Literature Review, Research Ethics, and Data Collection: The module develops students' ability to conduct a comprehensive literature review by locating, evaluating, and synthesizing scholarly sources while identifying research gaps. It also covers research ethics, including academic integrity, plagiarism, informed consent, confidentiality, and responsible research practices. In addition, students study sampling techniques, population selection, and the design and application of appropriate data collection methods such as questionnaires, interviews, observations, and document analysis, with consideration of reliability and validity. [14 hrs] Part (C) Data Analysis, Academic Writing, and Research Proposal : The module introduces the principles of qualitative and quantitative data analysis, including the interpretation and presentation of research findings. Students develop academic writing skills through the preparation of research proposals and reports, applying appropriate scientific writing conventions and citation and referencing styles (e.g., APA). The module concludes with the development, presentation, and evaluation of a research proposal that integrates the knowledge and skills acquired throughout the course. [17 hrs]
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The module employs a range of student-centred learning and teaching strategies to develop students' knowledge, practical research skills, and critical thinking. Teaching methods include interactive lectures, guided discussions, case studies, and the analysis of published research articles to introduce key concepts and methodologies. Students engage in individual and collaborative learning activities, literature searches, research planning exercises, and the development of data collection instruments and research proposals. Independent learning is supported through directed reading and research assignments, while presentations and constructive feedback encourage reflection, communication, and the application of research principles in authentic academic contexts.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا
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Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	45	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	30	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1	10% (10)	5, 10	LO # 1, 2, 3, 6, 8, 9, 10, and 13
	Online Assignments	1	10% (10)	2, 7, 12	LO # 2, 4, 5, 10, 11, 12, 13 and 14
	Onsite Assignments	1	10% (10)	2, 7, 12	LO # 2, 4, 5, 10, 11, 12, 13 and 14
	Projects / Lab. Report	0	0% (0)		
		1	10% (10)	13	LO # 1, 6 and 12
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المناهج الأسبوعية النظرية	
	Material Covered
Week 1	Introduction to Scientific Research: definition, purpose, characteristics, and research process
Week 2	Types of Scientific Research: basic, applied, qualitative, quantitative, and mixed methods
Week 3	Research Problem, Topic Selection, and Research Gap
Week 4	Research Objectives, Research Questions, and Hypotheses
Week 5	Literature Review: searching, evaluating, and synthesizing scholarly literature
Week 6	Research Ethics, Academic Integrity, Plagiarism, and APA Referencing
Week 7	Research Design and Methodology
Week 8	Midterm exam
Week 9	Sampling Techniques and Population Selection

Week 10	Data Collection Methods: questionnaires, interviews, observations, and document analysis
Week 11	Reliability, Validity, and Pilot Testing of Research Instruments
Week 12	Introduction to Qualitative and Quantitative Data Analysis
Week 13	Presentation and Interpretation of Research Findings
Week 14	Structure of a Research Proposal and Academic Writing
Week 15	Final Assessment Preparation
Week 16	The final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Leedy, Paul . Practical research: Planning and Design. Pearson Education UK, 2015.	No
Recommended Texts	Walliman, Nicholas. Research methods: The basics. Routledge, 2021.	No
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
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