جمهورية العراق
وزارة التعليم العالي والبحث العلمي
جامعة المستقبل
كلية العلوم
قسم التقنيات الاحيائية الطبية

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	**UOMU0307055**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	**3**	**Semester of Delivery**	**1**		
Administering Department	Type Dept. Code	**College**	**Sciences**		
Module Leader	**Dhurgham Ali Abbas**	**e-mail**	dhurgham.ali.abbas@uomus.edu.iq		
Module Leader's Acad. Title	professor	**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		**Version Number**	1.0		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	MBT-1101, MBT-1206	**Semester**	1,2
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1- Objectives. Understand the microbiological and ecological foundations that explain the participation of microorganisms in ecosystems and the great power existing in their biotechnological use.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After successful completion of the course, the student will be able to: 1. Familiarity with working principles, tools and techniques in the field of Environmental Biotechnology and Sustainability 2. Understanding of the strengths, limitations and potential dealing Environmental Biotechnology and Sustainability.
Indicative Contents	Student responsibilities:
المحتويات الإرشادية	1. Study of course materials as specified by the instructor 2. Timely submission of given class assignment

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Classroom lectures and discussions. 2. Case studies and examples from original research articles.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**79**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**5**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**61**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**1**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

تقييمModule Evaluation المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**3**	**10**	**4, 6, 10**	**#1 and#2, #3-#5, #9**
	Assignments	**2**	**10**	**13 and 14**	**#1 and #12**
	Projects / Lab.	**1**	**10**	**continuous**	**all**
	Report	**1**	**10**	**15**	**#14**
Summative assessment	**Midterm Exam**	**2h**	**10**	**7**	**#1-#6, #8-#14**
	Final Exam	**3h**	**50**	**16**	**all**
Total assessment			100% (100 Marks)		

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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Environmental Biotechnology and Sustainability:** Scope and applications of the subject. Basics of ecosystem structure and function
Week 2	**Microbial Ecology and Environmental Biotechnology:** Concepts and importance of microbial ecology in Environmental Biotechnology
Week 3	**Microbiology of Environmental Engineering System:** Microbial diversity, growth and decay. Stoichiometry of microbial energetics and kinetics.
Week 4	**Resource Exploitation by Microorganisms:** Functions of various microbial groups relevant to environmental systems, including waste treatment and resource recovery, implications in biogeochemistry.
Week 5	**Methods in Microbial Ecology with relevant to Environmental Biotechnology**: Culture
	dependent and - independent analyses of microbial communities; PCR based methods, Microarray, Environmental genomics
Week 6	**Microbial Principles of Biodegradation, Biodetoxification and other processes relevant for Environmental Applications:** Microbial engines, (metabolism), Requirements for biodegradation, acclimation, Common biotransformation mechanisms; Effect of organic contaminant structure on biodegradability; Cooperation between different microbial species for enhanced biodegradation; Applying biodegradation kinetics to fate and transport modeling
Week 7	**Common biotransformation mechanisms:** Effect of organic contaminant structure on biodegradability; Cooperation between different microbial species for enhanced biodegradation; Applying biodegradation kinetics to fate and transport modeling
Week 8	Med Exam.

Week 9	**Bioremediation Technologies:** Concepts, methods and applications of natural attenuation and engineered bioremediation (e.g bioaugmentation and biostimulation).
Week 10	**Microbial Interactions with Heavy Metals and Metalloids**: Bioremediation, Biohydrometallurgy and other aspects of Environmental Biotechnology
Week 11	**Aerobic and Anaerobic Degradation of Aliphatic and Aromatic Compounds:** Microbial interaction with plastics, antibiotics and others emerging pollutants.
Week 12	Microbially Enhanced Phosphorus and Nitrogen Removal
Week 13	**Microbially Enhanced Oil Recovery:** Microbial role in Carbon Storage and Capture (sequestration, conversion to useful biopolymers, etc.).
Week 14	**Case studies :** Bioremediation, Carbon Storage and Capture, Bioenergy.
Week 15	Preparatory week before final exam.
Week 16	**Final exam.**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Pollution, types and ways for renovate
Week 2	Bio remediation : An Environmentally Friendly Strategy for the Remediation of a Wide Range of Heavy Metals, Methods, Principles and Application
Week 3	Natural Attenuation, Bioaugmentation, Biostimulation, Bioleaching
Week 4	Phytoremediation mechanisms
Week 5	Methods for phytoremediation research Approaches to experimental design
Week 6	Method of plant digestion for heavy metal analysis
Week 7	Med Exam.
Week 8	Choice of ornamental plant in phytoremediation : calculation pollutant content and determination of plant remediated mechanism
Week 9	Phytoextraction of Heavy Metals by Fast- Growing Trees
Week 10	Enzymes Transferring Biomolecules to Organic Foreign Compounds: A Role for Glucosyltransferase and Glutathione S-transferase in phytoremediation
Week 11	Phytoremediation of Polychlorinated
Week 12	Active and sterile soil (baked) spiked with molecule to be determined (extraction solvent, efficiency, methods development, and identification) -
Week 13	Water extractions (difficult) – molecule to be determine –
Week 14	Physical and chemical environmental remediation
Week 15	Final Exam.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**

Required Texts	Books and references 1.Environmental Biotechnology, Principles and Applications by Bruce E Rittman and Perry L McCarty, McGrawhill Higher education. 2. Environmental Biotechnology Edited by Hans-Joachim Jördening and J Winter, WILEY-VCH Verlag Gmbh & Co.	
Recommended Texts	Bioremediation and Natural Attenuation by Pedro J J Alvarage and Walter A Illman, Wiley Interscience. 4.Environmental Biotechnology, Vol 10 Handbook of Environmental Engineering, Edited by L K Wang et al, Humana Press.	
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.