Name of HEI: Higher School of Biological Sciences of Oran **Departement : Second Cycle**

Syllabus of the Subject
Enzyme engineering 2: Immobilization of biological systems

LECTURE TEACHER		**Omar Khelil**			
		Student reception per week			
Email	omar.khelil.essbo@gmail.com	Day:	Sunday	Hour:	8h30-10h00
Office phone	_	Building:	Educational building	Bureau:	Enzyme Engineering Lab

Lab Session
(Student reception per week)

NAMES AND FIRST NAMES OF TEACHERS	Reception office/room	Session 1		Session 2	
		Day	Hour	Day	Hour
Amel Benyoucef	Enzyme Engineering Lab	Saturday	10h00- 12h30-	Monday	10h00- 12h30-
Bilek Nardjes Farah	Enzyme Engineering Lab	Tuesday	10h00- 12h30-	Wednesday	10h00- 12h30-

COURSE DESCRIPTION	
Objectives	1. Understand the principles and importance of immobilization in enzyme engineering and biotechnology. 2. Identify and evaluate different immobilization techniques for enzymes and cells. 3. Analyze the factors that influence the immobilization process and choose appropriate conditions for specific applications. 4. Characterize immobilized enzymes and cells using relevant techniques. 5. Apply immobilized enzymes and cells in various biotechnological processes. 6. Recognize the industrial applications and potential of immobilized enzymes and cells.
Type of Teaching Unit	Fundamental Teaching Unit
Succinct Content	The field of enzyme immobilization is a dynamic and interdisciplinary domain that sits at the intersection of scientific discovery and engineering innovation. It draws upon the principles of basic biochemistry and biophysics, requiring a profound understanding of the fundamental processes that govern biological systems. This fusion of scientific and engineering inputs is fundamental to the success of enzyme immobilization techniques. In this course, students will delve into the intricacies of enzyme immobilization, exploring its historical development, its wide-ranging applications in biotechnology and industry, and the critical factors that influence the choice of immobilization methods. As we embark on this journey, students will discover how the marriage of scientific insights with engineering prowess has paved the way for

	groundbreaking advancements in harnessing the potential of immobilized enzymes and biological systems.
Course Credits	4
Course Coefficient	2
Weighting for Participation	10%
Weighting for Attendance	10%
Calculation of Average CA	Average CA = (Lecture assessment x 0.1) + (Practical session assesments x 0.15) + (Laboratory notebook x 0.3) + (Lab report x 0.25) + (Lab final exam x 0.2)
Learning Outcomes	1. Understand the principles of enzyme immobilization and its crucial role in enhancing stability, reusability, and catalytic efficiency in biotechnological applications. 2. Demonstrate technical competence in selecting immobilization techniques for enzymes and cells based on specific applications, showcasing proficiency in diverse methodologies. 3. Analyze factors influencing immobilization, such as pH, temperature, substrate concentration, and matrix selection, to optimize conditions in practical scenarios. 4. Apply immobilized enzymes and cells in various biotechnological processes like biosensors and bioremediation, integrating theoretical knowledge with practical applications.

CONTINUOUS ASSESSMENT OF KNOWLEDGE							
FIRST ASSESSMENT (Lecture assessment)							
Day	Session	Duration	Type (1)	Permitted documents (Yes, No))	Grading scale	Discussion after evaluation (date of consultation of the copy)	Evaluation criteria (2)
	Lecture	-	Written	Yes	10%	-	S
SECOND ASSESSMENT (Lab assessments)							
Day	Session	Duration	Type (1)	Permitted documents (Yes, No))	Grading scale	Discussion after evaluation (date of consultation of the copy)	Evaluation criteria (2)
	Lab	10 min	Written	No	35%	-	A

(1) W: Written, IP: Individual presentation, CP: Class presentation, EX: Experimentation, MCQ: Multiple-Choice Questions

(2) Evaluation criteria: A: Analysis, S: Synthesis, AR: Argumentation, D: Approach, R: Results

EXPECTATIONS	
Expected from students (Participation-Involvement)	– Active Participation – Inquisitive Attitude – Respectful Engagement – Application of Knowledge
Expectations of the teacher	– Regular Attendance – Preparation – Collaborative Learning – Feedback and Reflection

BIBLIOGRAPHY	
Books and digital resources	1. Messing, R. (Ed.). (2012). **Immobilized enzymes for industrial reactors**. Elsevier. 2. Guisan, J. M. (Ed.). (2006). **Immobilization of enzymes and cells** (Vol. 22). Totowa, NJ: Humana Press. 3. Dwevedi, A. (2016). **Enzyme immobilization: advances in industry, agriculture, medicine, and the environment**. Springer. 4. Wingard, L. B., Katchalski-Katzir, E., & Goldstein, L. (Eds.). (2014). **Immobilized Enzyme Principles: Applied Biochemistry and Bioengineering**, Vol. 1. Elsevier.
Journal articles	1. DiCosimo, R., McAuliffe, J., Poulose, A. J., and Bohlmann, G. (2013) **Industrial use of immobilized enzymes**. Chemical Society reviews 42, 6437–74. 2. Fukui, S., & Tanaka, A. (1982). **Immobilized microbial cells**. Annual Reviews in Microbiology, 36(1), 145-172.

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