	Ministry of Higher Education and Scientific Research - Iraq **University of Diyala** **College of Science** **Department of Biotechnology**	

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information **معلومات المادة الدراسية**					
Module Title	**Gene-Chemo biotechnology**			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	BIOT35029				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	UGx11 UGIII		**Semester of Delivery**	5	
Administering Department	Biotechnology		**College**	Science	
Module Leader	Dr. Muthanna Al-Mahdawi Dr.		**e-mail**	dr.muthanna@uodiyala.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Dr. Muthanna Al-Mahdawi Dr. Athmar Adnan		**e-mail**	dr.muthanna@uodiyala.edu.iq athmaradnan@uodiyala.edu.iq	
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Scientific Committee Approval Date	10/9/2025		**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**	● This course includes covering the concepts of biochemical and genetic techniques. It aims to deal with microorganisms, plant and animal cells in the medical and industrial fields, and their components of vital compounds, by applying all modern technologies. ● In the investigation of proteins and methods of extraction, as well as methods of purification and determination of molecular weight. ● In the investigation of DNA and methods of extraction and purification and detection of damage resulting in addition to the control of gene expression.
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	1. Extraction, precipitation of Protein. 2. Protein purification. 3. Calculations and Preparing a Purification Table. 4. Column chromatography. 5. Estimation of molecular weight by gel filtration. 6. Structure and Function of DNA. Control the cloned gene expression under transcription and translation. 7. The Nucleic acid purification. 8. Understand the quantification method for detect the DNA damage (by: Comet assay technique). 9. Technique for Quantitative detection of specific DNA sequences. 10. Understand the process of transformation techniques.
Indicative Contents **المحتويات الإرشادية** **(يتضمن الكلمات المفتاحية المهمة للمحاضرات)**	**Indicative content includes the following.** **Part A – Gene-chemo biotechnology of Protein techniques.** - **Introduction of Protein purification**: define of Protein purification, method of Extraction protein. [5. Hrs.] - **Precipitation and differential solubilization:** Ammonium sulfate precipitation by (NH4)2SO4, salting out, salting in, Dialysis, method of Removing the ammonium sulphate, Ultracentrifugation, Purification table. - **Column chromatography:** define; Common types of chromatographic stationary phases, Ion exchange resins contain charged groups. [11 hrs.] - **Gel filtration chromatography:** Types of gels used; Dextran, Polyacrylamide, Agarose, Advantages of Gel filtration, Applications of gel filtration. [8. Hrs.] - **Estimation of molecular weight by gel filtration:** Elution volume (Ve), Relative elution volume (Ve/V0), Void volume, Vo. [6 hrs.] - **Application of** Estimation of molecular weight of unknown protein. [12 Hrs] - **Application of precipitation table**. [5 hrs.] **Part B - Gene-chemo biotechnology of DNA techniques.** **- Structure & Function of DNA** – Nucleoside, Ncleotide, Reversible Denaturing of DNA, Melting temperature (Tm). [5 hrs.] **- Gene Technology** – Optimization of cloned genes expression, Promoters, *lac* Promoters, *Trp* Promoters, (б) factor, expression vectors, Shine-Dalgarno(S-D) sequence, Coding usage, Short tandem repeats (STRs), simple sequence repeats (SSRs), *E. coli*. [11 hrs.] **- The Nucleic acid purification** – DNA purification, EtBr-CsCl gradient, Solid-phase, Nucleic Acid Extraction, cell lysis, oligo(dT), affinity chromatography, Isolate mRNA. [8 hrs.] **- Comet assay technique** – single-cell gel electrophoresis, (SCGE), fluorescent dye, epifluorescence microscopy, genotoxicity testing, mechanistic studies of DNA damage and repair. [6 hrs.]

	- **Nucleic Acids Detection Techniques**- genetically modified organisms, (GMO), Quantitative detection of specific DNA sequences, Southern blotting, Northern blotting, Identify inherited disease, electrophoretic, nitrocellulose paper support, radioactive probe, formaldehyde, Capillary blotting, hybridization. [12 hrs.] - **Polymerase chain reaction& Microarray technique** – Denaturation, Primer Annealing, Extension, Taq polymerase, DNA amplification, Polymorphisms, parallel gene expression analysis, Manufacturing of microarrays, cDNA, DNA Gene Chip, Affymetrix, Allele. [12 hrs.] - **DNA Exchanged –** transformation, naturally transformable bacteria, competent cells, heat shock, Electroporation. [5 hrs.]

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 تملأ من قبل مقرر القسم**			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	64	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	61	**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**					
As		**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	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**	2hr	10% (10)	15	LO # 1-14
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Weeks	**Material Covered**
Week 1	- Introduction to Protein purification
Week 2	- Precipitation and differential solubilization
Week 3	- Introduction of Column chromatography
Week 4	- Ion exchange chromatography
Week 5	- Gel filtration chromatography
Week 6	- Estimation of molecular weight by gel filtration:
Week 7	- Application of Estimation of molecular weight of unknown protein
Week 8	- DNA Exchanged
Week 9	- Structure & Function of DNA
Week 10	- Gene Technology
Week 11	- The Nucleic acid purification
Week 12	- Comet assay technique
Week 13	- Nucleic Acids Detection Techniques
Week 14	- Polymerase chain reaction& Microarray technique
Week 15	- **The Midterm Exam**
Week 16	- **Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Week	**Material Covered**
Week 1	Lab 1: Biosafety and Biosecurity/ introduction to instruments used at Biotechnology Labrotary
Week 2	Lab 2: Extraction methods of protein
Week 3	Lab 3: Precipitation of Protein
Week 4	Lab 4: Ion Exchange Chromatography
Week 5	Lab 5: Gel filtration Chromatography
Week 6	Practical Exam.
Week 7	Lab 6: DNA Extraction /Nucleic acid purification
Week 8	Lab 7: Plasmid DNA Isolation
Week 9	Lab 8: Polymerase Chain Reaction
Week10	Lab 9: Application of primer design
Week 11	Lab 10: Application NCBI / DNA and Protein sequence online databases

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Hofmann, A., & Clokie, S. (Eds.). (2018). *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology* (8th ed.). Cambridge: Cambridge University Press.	Yes
Recommended Texts	John M Walker and Ralph Rapley (2009). Molecular Biology and Biotechnology, 5th Edition. Published by the Royal Society of Chemistry, www.rsc.org	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.