	Ministry of Higher Education and Scientific Research - Iraq Al-Nahrain University College of Science Physics Department	

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Bioanalytical Techniques			**Module Delivery**	
Module Type	CORE			☒**Theory** ☒**Lecture** ☒**Lab** ☒**Tutorial** ☐**Practical** ☒**Seminar**	
Module Code	APPA2215				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		2	**Semester of Delivery**		4
Administering Department		Applied Pathological Analysis	**College**	College of Science	
Module Leader	Wisam Kadhum H- Al-Hashemi		**e-mail**	Wisam.kadhim@nahrainuniv.edu.iq	
Module Leader's Acad. Title		Assistance Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	M.Sc. Adhraa Abdulameer		**e-mail**	athraa.a.s@nahrainuniv.edu.iq	
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Review Committee Approval		18\1\2025	**Version Number**		1
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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 الدراسي ة	• To provide students with a comprehensive understanding of the principles and applications of bioanalytical techniques in life sciences. • To develop practical skills in using advanced instrumentation and methodologies for analyzing biological molecules. • To prepare students for research and industry roles by fostering critical thinking and problem-solving skills in bioanalytical science.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسي ة	By the end of the module, students will be able to: **Knowledge**: 1. Explain the theoretical principles behind key bioanalytical techniques, including spectroscopy, chromatography, electrophoresis, and mass spectrometry. 2. Describe the applications of bioanalytical techniques in life sciences, such as protein analysis, metabolite profiling, and structural biology. **Skills**: 3. Operate and maintain common laboratory instruments, such as spectrophotometers, centrifuges, and pH meters. 4. Perform experiments using bioanalytical techniques, including sample preparation, data collection, and analysis. **Competencies**: 5. Critically evaluate experimental data and troubleshoot common issues in bioanalytical workflows. 6. Design and execute a research project using appropriate bioanalytical techniques to address a scientific question.		

Indicative Contents المحتويات الإرشادية	The module will cover the following topics: 1. **Introduction to Bioanalytical Techniques**: ○ Overview of techniques and their applications in life sciences. ○ Importance of accuracy, precision, and reproducibility in bioanalytical science.

	2. **Spectroscopic Techniques**: ○ UV-Vis, fluorescence, and infrared spectroscopy. ○ Applications in protein quantification and structural analysis. 3. **Chromatography**: ○ Principles of HPLC, GC, and TLC. ○ Separation and identification of biomolecules. 4. **Electrophoresis**: ○ SDS-PAGE and agarose gel electrophoresis. ○ Applications in protein and nucleic acid analysis. 5. **Mass Spectrometry**: ○ MALDI-TOF and ESI-MS. ○ Applications in proteomics and metabolomics. 6. **Centrifugation**: ○ Differential and density gradient centrifugation. ○ Isolation of cellular organelles and macromolecules. 7. **Immunological Techniques**: ○ ELISA, Western blotting, and immunofluorescence. ○ Applications in diagnostics and research. 8. **Microscopy**: ○ Light, fluorescence, and electron microscopy. ○ Applications in cell biology and pathology. 9. **Electrochemical Techniques**: ○ Potentiometry and ion-selective electrodes. ○ Applications in clinical and environmental analysis. 10. **Biosensors and Bioassays**: ○ Principles of biosensors and their applications in diagnostics. ○ Enzyme kinetics and assays. 11. **Emerging Techniques**: ○ Single-cell analysis, nanotechnology, and advanced imaging. ○ Future trends in bioanalytical science.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	

Strategies	1- **Active Participation:** Engage in class discussions, ask questions, and contribute to group activities. 2- **Hands-on Practice:** Maximize learning in lab sessions by actively participating in experiments and data analysis. 3- **Problem-Solving:** Practice solving problems related to bioanalytical techniques, focusing on understanding the underlying principles. 4- **Critical Thinking:** Evaluate data critically, identify potential sources of error, and interpret results in the context of the experiment. 5- **Collaboration:** Work effectively with peers in group projects and lab activities. 6- **Independent Learning:** Supplement classroom learning with

	independent reading, research, and practice. 7- **Effective Communication:** Clearly communicate experimental results and interpretations in lab reports and presentations. 8- **General Teaching Strategies (for instructors):** 9- **Varied Instruction:** Use a mix of lectures, demonstrations, hands-on labs, discussions, and problem-solving activities. 10- **Real-World Relevance:** Connect bioanalytical techniques to real-world applications in life sciences. 11- **Clear Explanations:** Explain complex concepts in a clear and concise manner, using visual aids and examples. 12- **Hands-on Learning:** Provide ample opportunities for students to develop practical skills in the lab. 13- **Data Analysis Focus:** Emphasize data analysis and interpretation, providing students with the necessary tools and skills. 14- **Active Learning Techniques:** Incorporate activities like think-pairshare, small group discussions, and case studies. 15- **Feedback and Assessment:** Provide regular feedback on student progress and use a variety of assessment methods. 16- **Technology Integration:** Utilize online resources, simulations, and software tools to enhance learning. 17- **Student-Centered Approach:** Create a learning environment that is supportive and encourages student participation. 18- **Flexibility and Adaptability:** Be prepared to adjust teaching strategies based on student needs and feedback. 19- **Key Areas of Focus (integrated into both learning and teaching):** 20- **Fundamental Principles:** Ensure students have a solid understanding of the basic principles underlying each technique. 21- **Practical Skills:** Develop proficiency in performing common bioanalytical techniques. 22- **Data Interpretation:** Gain skills in analyzing and interpreting data generated from bioanalytical experiments. 23- **Troubleshooting:** Learn to identify and troubleshoot common problems encountered in the lab. 24- **Applications:** Understand the applications of bioanalytical techniques in various life science fields. 25- **Safety:** Emphasize lab safety and proper handling of biological materials and equipment. 26- **Ethical Considerations:** Discuss ethical considerations related to bioanalytical research.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	102	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	98	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation تقييم المادة الدراسي ة					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	4	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	
	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)		

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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Bioanalytical Techniques
Week 2	Spectroscopic Techniques 1
Week 3	Spectroscopic Techniques 2 UV-VIS
Week 4	Spectroscopic Techniques 3 Atomic absorption and emmission
Week 5	Chromatography Techniques
Week 6	Electrophoresis
Week 7	Centrifugation Techniques
Week 8	Mid exam
Week 9	Protein Purification Techniques
Week 10	The Organic Mechanisms of the Coenzymes
Week 11	Enzyme Kinetics and Assays
Week 12	Immunological Techniques
Week 13	Advanced immunoassyas 1
Week 14	Biosensors and Bioassays
Week 15	Preparatory Week
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab safety, instrumentation, and introduction to lab protocols.
Week 2	UV-Vis spectroscopy for determination of maximum wavelength
Week 3	UV-Vis spectroscopy for determination of unknown concentration
Week 4	Thin-layer chromatography (TLC) for separation of amino acids.
Week 5	SDS-PAGE for protein separation (electrophoresis)
Week 6	Isolation of cellular organelles using differential centrifugation.

Week 7	ELISA for antigen detection
Week 8	Western Immunoblotting
Week 9	Michaelis-Menten kinetics using a spectrophotometric assay
Week 10	Measurement of pH using a pH meter and ion concentration using ISEs
Week 11	Glucose biosensor demonstration.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	4th Edition Analytical Chemistry for Technicians By John Kenkel Copyright 2014	no
Recommended Texts	**BIOANALYTICAL CHEMISTRY** by Andreas Manz (Author), Nicole Pamme (Author), Dimitri Iossifidis (Author)	
Websites		

APPEN
DIX:

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	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

NB 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.



ملاحظة: هذا النموذج تم وضعه وتقديمه من قبل مديرية ضمان الجودة في وزارة التعليم العالي والبحث العلمي