Republic of Yemen

Ministry of Higher Education & Scientific Research

21 SEPTEMBER UNIVERSITY of MEDICALS & APPLIEED

SCIENCES

Faculty of Laboratory Medicine

Department of Microbiology & Immunology

Course Specification of Advanced Diagnostic and Molecular Microbiology

Course No. (03.12. 318)

2022/2023

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Assistant Prof. Dr Ghamdan Al-Tahish	Prof. Dr. Khalid A. AL-Moyed	Dr Gamil Taher Abdul Mughni	Dr Gamil Taher Abdul Mughni	Ass.Pr. Dr. Ebtesam Al-Zabedi

I. Course Identification and General Information:

1	**Course Title:**	Advanced Diagnostic and Molecular Microbiology			
2	**Course Code & Number:**	03.12. 318			
3	**Credit Hours:**	**Theory Hours**			
		Lecture	**Exercise**	Practical	**Credit Hours**
		4		0	4
4	**Study Level/ Semester at which this Course is offered:**	1st Level / 2nd Semester			
5	**Pre –Requisite (if any):**	Advanced Molecular Microbiology			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Master of Medical Microbiology & Immunology			
8	**Language of Teaching the Course:**	English			
9	**Study System:**	Semester			
10	**Mode of Delivery:**	Full times			
11	**Location of Teaching the Course:**	University Campus			
12	**Prepared by:**	Dr. Ghamdan Altahish i			
13	**Date of Approval:**	2022-2023			

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II. Course Description:

This course aims to provide advanced knowledge and skills in the field of diagnostic microbiology. It covers the principles and applications of advanced diagnostic techniques] used for the identification and characterization of bacteria, viruses, fungi, and parasites. Covering range of molecular techniques used for laboratory diagnosis and management of infections, such as nucleic acid extraction PCR-based methods, blotting techniques, electrophoresis, microarray, In Situ Hybridization, bioinformatics and DNA sequencing. The course focuses on the interpretation of laboratory results and the development of effective treatment strategies for infectious diseases.

III. Alignment Course Intended Learning Outcomes with program outcomes

III. Course Intended Learning Outcomes (CILOs)		Referenced PILOs
A. Knowledge and Understanding: **Upon successful completion of the course, students will be able to:**		
a1	Explain the principles of molecular diagnostic techniques, including nucleic acid extraction, amplification, sequencing, and hybridization	A1, A4.
a2	Describe advanced molecular methods such as real-time PCR, DNA microarrays, and isothermal amplification (LAMP, SDA, TMA)	A4
a3	Discuss applications of recombinant DNA technology in diagnostics, including cloning and genetic engineering	A1, A4.
B. Intellectual Skills: **Upon successful completion of the course, students will be able to:**		
b1	Select appropriate molecular techniques for pathogen detection, typing, and resistance profiling	B2, B3.
b2	Interpret diagnostic results from blotting, PCR variants (nested, multiplex, RT-PCR), and sequencing	B1, B2
b3	Design protocols for pathogen identification using molecular tools like LCR, TMA, and DNA microarrays	B3.
D. Transferable Skills: **Upon successful completion of the course, students will be able to:**		
d 1	Communicate diagnostic findings through structured reports and presentations for clinicians and researchers	**D1**
d2	Write research articles documenting molecular workflows and data interpretation	**D3**

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IV. Alignment Course Intended Learning Outcomes with Teaching Strategies and Assessment methods :			
(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1	Explain the principles of molecular diagnostic techniques, including nucleic acid extraction, amplification, sequencing, and hybridization	Lectures, seminar and student presentations, case studies	Exam
a2	Describe advanced molecular methods such as real-time PCR, DNA microarrays, and isothermal amplification (LAMP, SDA, TMA)	Lectures, seminar and student presentations, case studies	Exam
a3	Discuss applications of recombinant DNA technology in diagnostics, including cloning and genetic engineering	Lectures, seminar and student presentations, case studies	Exam
(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1	Select appropriate molecular techniques for pathogen detection, typing, and resistance profiling	Lectures, small group for discussion, case studies	Exam
b2	Interpret diagnostic results from blotting, PCR variants (nested, multiplex, RT-PCR), and sequencing	Lectures, small group for discussion, case studies	Exam
b3	Design protocols for pathogen identification using molecular tools like LCR, TMA, and DNA microarrays	Lectures, small group for discussion, case studies	Exam
C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d 1	Communicate diagnostic findings through	Lectures	Exam

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	structured reports and presentations for clinicians and researchers		
d2	Write research articles documenting molecular workflows and data interpretation	Lectures	Exam

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Nucleic acid extraction**	DNA extraction methods – Sample source, assessment of quality and quantity, nucleic acid storage	`1	2	a1,
2	**Nucleic acid extraction**	RNA extraction methods Sample source, assessment of quality and quantity, nucleic acid storage	1	2	a1,
3	**blotting techniques**	Identification Hybridization , blotting and probe. Types , procedures and uses of blotting techniques Southern, northern and dot/slot blot; RFLP : (Principles. steps. Reaction Components and Applications);2	1	2	a1
4	**In situ nucleic acid hybridization & DNA Microarray**	FISH: (Principles steps Reaction Components Applications) DNA chip (Principles steps . Reaction Components	1	2	a2, b3

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		applications)			
5	**nucleic acid amplification techniques**	Types PCR: principles applications Principles steps reaction Components Variants of the PCR Applications optimization of PCR reactions, contaminants, analysis and verification of PC R products	1	2	a1,
6	Nested PCR , multiplex PCR and hot start PCR **Reverse transcriptase PCR,**	Principles steps reaction Components Variants of the PCR Applications	1	2	a1,b1, b2,
7	**Midtem exam**		1	2	a1-a3,b1-b3, ,d1,d2
8	**Electrophoretic**	TYPES Principles steps reaction Components Applications	1	2	a1, ,
9	**Real-time PCR**	Principles steps Reaction Components Applications	1	2	a1,b1, b2,
10	**DNA sequencing techniques**	applications of DNA sequencing in the clinical laboratory. Principles steps reaction Components Applications	1	2	b2,
11	**Recombinant**	Principles steps	1	2	a3, b3

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	DNA technology	reaction Components Applications			
12	**DNA Cloning**	Principles steps Reaction Components Applications	1	2	a3, b3
١٣	TMA SDA	Principles types Reaction Components Applications	1	2	a2, b3,
١٤	**LAMP** **LCR**	Principles types Reaction Components Applications	1	2	a2, b3,
١٥	**Typing**	Principles Types steps applications	1	2	a1, b1, b3,
١٦	**Final Theoretical Exam**		1	2	a1-a3,b1-b3, ,d1,d2
Number of Weeks /and Units Per Semester			**16**	**32**	

V. Teaching Strategies of the Course:	
1-	Lectures
2-	Practical session
3-	Self leaning
4-	**Group research**

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VI. Assessment Methods of the Course:		
No	**Assignment**	
1	**Written Exams (Short Essays) and Quizzes**	a1-a3,b1-b3, ,d1,d2
2	Written Exams(MCQ)	a1-a3,b1-b3, ,d1,d2
3	Structured Oral Exams	a1-a3,b1-b3, ,d1,d2
4	Practical Exams (OSPE)	a1-a3,b1-b3, ,d1,d2
5	Student presentation	a1-a3,b1-b3, ,d1,d2

VII. Assignments:					
No.	**Assignments**	**Week Due**	**Mark**	Proportion of Final Assessment	**Aligned CILOs (symbols)**
1	**Midterm Exam**	7	25	25%	a1-a3,b1-b3, ,d1,d2
2	**Activity**	Throughout the semester	5	5%	a1-a3,b1-b3, ,d1,d2
5	**Final Exam**	16	70	70%	a1-a3,b1-b3, ,d1,d2
Total					

IX. Learning Resources:

- *Written in the following order:* Author, Year of publication, **Title**, Edition, Place of publication, Publisher.

1- Required Textbook(s) (maximum two): مثال example

1- Molecular Microbiology: Diagnostic Principles and Practice" by David H. Persing, Fred C. Tenover, Randall T. Hayden, and others

2- Coleman, W. B., & Tsongalis, G. J. (1997). *Molecular diagnostics: For the clinical laboratories*. Totowa, NJ: Humana Press.

3- Glick, B. R., Pasternak, J. J., & Patten, C. L. (2010). *Molecular biotechnology: Principles and*

applications of recombinant DNA. Washington, DC: ASM Press

2- Essential References:

1- Lela Buckingham and Maribeth Flaws .Molecular Diagnostics: Fundamentals, Methods and Clinical Applications, 2nd edition. ISBN-13: 978-0-8036-2677-5

2- Molecular Microbiology Laboratory: A Writing-Intensive Course" by Walt Ream and Katharine G. Field

3- Electronic Materials and Web Sites etc.:

Websites:

1- http://www.asmusa.org\

2- http://www.phage.org/black09.htm

3- http://www.microbe.org/microbes/virus_or_bacterium.asp

XI. *Course Policies:*	
1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** -If the student dose not attend for more than 6 times, the student will be obligated to withdrew from the course
3	**Exam Attendance/Punctuality:** No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and

	regulations of the examination set by the Department, Faculty and University Administration

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