



21 September University for Medical & Applied Sciences

**Faculty of Laboratory Medicine**

# Program Specifications

## Master Degree

of

Medical Microbiology and Immunology

Code: 03,02

2021/2022



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## Program Specification

### 1- Program Identification and General Information:

Program Identification and General Information:		
1	Program title:	Master degree in Medical Microbiology & Immunology
2	Department responsible for the program:	Medical Microbiology & Immunology
3	Degree offered	Master of Medical Microbiology & Immunology
4	The Institute responsible for granting the degree:	21 September University of Medical & Applied Sciences
5	Study system:	Single
6	Study language of the program:	English
7	Entry requirements:	Bachelor's degree Laboratory Medicine or other equal degrees
8	Departments participating in the program:	Medical Microbiology & Immunology Faculty of Faculty of Laboratory Medicine
9	Starting year of the program:	2022-2023
10	Study methods in the program:	
11	Location of delivery:	21 September University of Medical & Applied Sciences, Faculty of Faculty of Laboratory medicine , Medical Microbiology & Immunology
12	The program resources:	21 September University of Medical & Applied Sciences
13	Minimum grade requirements:	As per regulations of the Ministry of Higher education and Scientific Research
16	Other admission requirements:	According to the University rules and regulations
14	Date of current development of the program :	February 2022
15	Prepared by :	- Prof. Dr. Mojahed Ali Measar - Prof. Dr. Khaled A. Al-Moyed - Associate Prof. Dr. Ebtessam Al-Zabedi - Assistant Prof. Dr Ghamdan Al-Tahish - Assistant Prof. Dr. Gamil Abdul-Mughni
16	Program coordinator:	Assistant Prof. Dr. Gamil Taher Abdul-Mughni



## 2) Program Overview:

The Master program provides students a broad background in microbiology, immunology and the techniques used in microbiology and immunology research. The average amount of time to completion is two years. The Main Areas of Research are **Medical Microbiology, Immunology with Molecular Biology**

## 3-University Vision, Mission, and Goals:

### University vision 2025:

A contemporary university with national responsibility and a faith identity

### University mission:

Leading the transformation in the management and delivery of health care with all partners by setting a standard of excellence in education and medical and applied research in a way that meets the needs of Yemeni society, its privacy and regional influence.

### University objective:

1- Ensuring the application of quality standards and setting standards of excellence in medical and applied sciences, scientific research and community service.

2. The centrality of the student in the educational process, the partnership with them for life, the consolidation of the principles of national responsibility and faith identity, their care and the development of their capabilities after graduation and during work.

3. Attracting, employing and retaining scholars, cadres and highly specialized talents to gain minds and reverse the trend of “brain drain” in a way that enhances and ensures the creation of thinkers, businessmen and good citizens.

4. Continuous development of the distinguished academic infrastructure and the establishment of modern research and service centers with high efficiency and capable of making a real impact locally and regionally.

5. Enhancing the university's position as a preferred partner for local, regional and international partnership through implementing innovative models of education, exchanging research and knowledge and providing real and effective outcomes for developing professional practices to benefit from them locally and regionally

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## ***B. Mission, Objective, and Learning Outcomes of the master program***

### **I. Mission :**

To prepare highly qualified graduate skilled in the medical microbiology and immunology through advanced learning, practices and conducting scientific research.

### **II. General objectives of the program:**

- 1- Produce health science professionals and in-depth medical microbiological and immunology knowledge of different emerging infectious disease and clinical immunology.
- 2- Promote our students to practice health care associated infection monitoring and prevention in academic and clinical settings.
- 3- Provide our candidate with the ability to apply different and recent molecular biological and immunological techniques in the field of microbiology
- 4- Give the candidate the ability to assess immunological status in different pathological condition with gaining knowledge about immunological role in development of different disease and how to target by immunotherapy
- 5- Provide opportunities to gain research capacity and publish scientific relevant studies.
6. Promote community partners and stakeholders for program development, evaluation and improvement and active participation in professional societies.

### **III. Graduate Attributes of the program**

*Upon successful completion of the program in master of Medical Microbiology and Immunology, the graduates will be able to:*

1. Demonstrate advanced knowledge in the fields of Medical Microbiology and Immunology.
2. Demonstrate independent critical and analytical thinking, both within their field of study, and beyond for the use of their knowledge for service to others.
3. Identify and suggest possible solutions to ethical dilemmas that occur in their work and field of study, and understand the importance of professional ethics in all aspects of scientific communication and laboratory work.
4. Demonstrate competence in the laboratory, including application of the scientific method and appropriate use of basic and state of the art laboratory tools and techniques.
5. Demonstrate written and oral skills necessary for communication of research, knowledge, and ideas to scientists and non-scientists alike.



<b>4. Intended Learning Outcomes from the program:</b>	
<b>A. Knowledge and understanding:</b>	
<i>At the end of the course the student should be able to</i>	
1	<b>Understand</b> the basic Specific knowledge in medical microorganisms and immunology, including molecular biology, immunology and DNA technology coupled with hands on skills and leadership skills for a successful career.
2	<b>Describe</b> the important mechanisms of microbial pathogenesis, modes of transmission, eliminated, clarify treatment and outcomes of infections with emphasis on cellular and molecular immunology and immunity to infections
3	<b>List</b> the key considerations and principles in the planning and design of a study on the basis of statistical methods.
4	<b>Discuss</b> the different microbial and immunology diseases and the principle different laboratory techniques, including the isolation, characterization of specific microbes, seroimmunology and nucleic acid in clinical specimens
<b>B. Intellectual Skills:</b>	
<i>At the end of the course the student should be able to</i>	
1	<b>Interpret</b> and explain results simply and effectively to clinicians and patients
2	<b>Illustrate</b> important mechanisms of microbial pathogenesis, basic concepts of molecular immunology, immunity to infection, risk of infection, outcomes of infections and vaccines for individual infectious or immunological disease.
3	<b>Design</b> guidelines for prevention, control of infection/disease and antibiotic treatment regimens used for managing microbial and immunological diseases.
4	<b>Categorize</b> health risk factors associated with working in a research diagnostic laboratory
<b>C. Professional and Practical Skills:</b>	
<i>At the end of the course the student should be able to</i>	
1	<b>Demonstrate</b> important mechanisms of microbial pathogenesis, basic concepts of molecular immunology, immunity to infection, risk of infection and outcomes of infections
2	<b>Perform</b> diagnostic laboratory tests in medical bacteriology, virology, mycology and immunology to offer basic advice on relevant investigations, interpretation of results and infection control procedures in association with quality assurance and control procedure.

3 **Applied** laboratory data relevant to the cases of medical microbiology, immunology and identified the pathogen by the isolation and its specific growth characteristics if any, distinguishing biochemical tests, its morphological and/or staining characteristics, immunological or nucleic acid-based tests..

**D. General and Transferable outcomes:**

*At the end of the course the student should be able to*

- |   |  |
|---|--|
| 1 | <b>Communicate</b> effectively through oral presentations, computer processing and presentations, and written reports. |
| 2 | <b>Respect</b> the role of staff and co-staff members regardless of degree or occupation.                              |
| 3 | <b>Write</b> scientific article according to the basics of scientific research   |



## Program Standards & Benchmarks

### Academic Standards:

-NARS (National Academic References Standard) for medical education in Yemen

-Academic Standards Curriculum Criteria of Accreditation Board

-Unified Regulations for Student Affairs, Ministry of Higher Education and Scientific Research

### Benchmarks

1-Faculty of medicine and health Sciences, Sana'a university, Yemen

2- Beirut Arab University (BAU) Lebanon

<https://www.bau.edu.lb/Program/Health-Sciences/Master/Master-in-Medical-Laboratory-Sciences--Microbiology-and-Immunology-Track>

3- Jordan University of Science and Technology (JUST) Jordan

<https://www.just.edu.jo/FacultiesandDepartments/FacultyofAppliedMedScs/Depts/MedLabSciences/Documents/MSc%20in%20Medical%20Laboratory%20Sciences%20Program%20Information.pdf>

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<https://www.just.edu.jo/FacultiesandDepartments/FacultyofAppliedMedScs/Depts/MedLabSciences/Pages/viewplan.aspx?planno=275>

4-Mahidol University

-University of Michigan Medical School

<https://medicine.umich.edu/dept/microbiology-immunology>

<https://medicine.umich.edu/dept/microbiology-immunology/education/masters-program>

Umm Al-Qura University





### Teaching and Learning Strategies:

- Lectures
- Seminars
- Lab experiments
- Training
- Discussion
- Presentations
- Self-learning
- Case study

### Teaching strategy:

Teaching Strategy	Description of how it will be used
Lectures	It is the most frequently employed teaching method to convey knowledge and explain theories to students in large groups or in sessions, which consist of more than one group gathered in one classroom.
Seminars	These are mainly used with small groups of students in which they find better chances for discussing and negotiating the different concerns of their studies.
Lab experiments	Students doing practices in medical labs individually or in small groups.
Training	This is a practical kind of course where the students are required to plan and execute some field visits to hospitals, corporations or institutions where the process of clinical pharmacy is essential.
Discussion	This is done by allowing the students to ask questions during the lecture and respond to them by the lecturer or other students for the purpose of establishing and clarify the subject of the lecture strongly and increase the concentration and absorption of the student and the attention and not to enter the boredom.
Presentations	Helps the students to be more confident with themselves and make them to show the others what knowledge they have acquired. It can be followed in many types of courses and tasks.
Self-learning	Self-learning is the process by which learners teach themselves using any materials or resources to achieve clear goals without the direct help of the teacher
Case study	Case studies are defined as the scientific documentation of a single clinical observation which is so important study design in advancing medical scientific knowledge especially of rare disease.
Office Hours	Office hours are hours determined by the faculty member (professor of the course) to which the student studies. The hours allocated by the professor to meet with his students to help them and answer their queries in the event of any questions they may not be enough time for the lecture to answer it.



Assessment Methods:
<ul style="list-style-type: none"> <li>• Written examinations</li> <li>• Oral exams</li> <li>• Technical or practical reports /Presentations</li> <li>• Assignments including problem-solving exercises</li> <li>• Individual and group project work</li> <li>• Quizzes</li> <li>• Home work</li> </ul>

Assessment Strategies:	
Assessment Strategy	Its description (in which course it will be used and in which rate)
Written examinations	Mid-term test is conducted between 6th to 8th Class and final exam is conducted at the end of each course.
Oral exams	For selected courses
Technical or practical reports /Presentations	As indicated in the course specification
Assignments including problem-solving exercises	The entire assignments including problem-solving exercises of coursework activities during the teaching period of each course. (which includes group and individual work, tests and presentations, etc.)
Individual and group project work	As indicated in the course specification
Quizzes	For all courses except for project
Home work	For all courses except for project

1. Alignment of Program Intended Learning Outcomes (PILOs) to Teaching Strategies and Assessment Methods:		
PILOs	Teaching Strategy	Assessment Methods
<b>Knowledge and Understanding A1, A2, A3, A4</b>	Lectures, Interactive class discussions, Tutorials.	Written exams, assignment work, quizzes, submission of reports.
<b>Intellectual Skills B1, B2, B3, B4</b>	Lectures, Tutorial, Interactive class discussions, and group work, presentation.	Written exams, Project, Case studies and assignment work.
<b>Professional &amp; practical skills C1, C2, C3,</b>	Short lectures, case study, Laboratory experiments, Project, and group work, Field training, Drawing sessions.	Written exams, quizzes, Practical exam assignment and report submission.
<b>General &amp; Transferable Skills D1, D2, D3</b>	Group work, Self-study, Interactive class discussions, Tutorials, Seminar/ project/presentation, Laboratory experiments, Project, and Art Gallery	Project presentation, Laboratory exam, Report/Project



### 1. Project Assessment:

Each project will be assessed by a committee of three members as follows:

Item	Marks Distribution
Project supervisor	60%
Internal examiner: a member of the department staff.	20%
External examiner: a qualified external examiner (either from other departments of the faculty or from another university)	20%
<b>Total</b>	<b>100%</b>

### Program Structure and Contents

Study System	
I-Duration of program	2 – 4 years maximum 4 years divided into courses and thesis
II. Structure of the program:	Total contact number of credit hours 36
-First year	Program-related essential courses and Students ILOs
Thesis	MSc thesis subject should be officially registered within 6 months from application of the MSc degree, Discussion and acceptance of the thesis could be set after 12 months from MSc registering date.

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### Program course:

	Course Compulsory	Code	Credits hours
1	Advanced Molecular Microbiology	03.12. 311	3
2	Advanced Biostatistics and Epidemiology	03.12. 312	3
3	Advanced Medical Bacteriology	03.12. 313	3
4	Advanced Immunology	03.12. 314	3
5	Advanced Medical Virology	03.12. 315	2
6	Advanced Medical Mycology	03.12. 316	2
7	Research Methods, Research Proposal and Scientific Writing	03.12. 321	2
8	Advanced Diagnostic Microbiology and Molecular Biology.	03.12. 322	4
9	Advanced Cellular and Molecular Immunology	03.12. 323	3
10	Advanced Medical Parasitology	03.12. 324	2
11	Thesis	03.12.333	6
	Special Course (Choose one)		3
12	Special Topics in Immunology and Serology	03.12. 325	
13	Special Topics in Clinical Microbiology	03.12. 326	
14	Special Topics in Molecular Diagnostic Microbiology	03.12. 327	
	<b>Total</b>		<b>36</b>

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## Study Plan

Distribution of Courses according to Semesters (36 credit hours)

First semester		Code	Credit Hour
1	Advanced Molecular Microbiology	03.12. 311	3
2	Advanced Biostatistics and Epidemiology	03.12. 312	3
3	Advanced Medical Bacteriology	03.12. 313	3
4	Advanced Immunology	03.12. 314	3
5	Advanced Medical Virology	03.12. 315	2
6	Advanced Medical Mycology	03.12. 316	2
<b>Total</b>			<b>16</b>

		Code	Credit Hour
1	Research Methods, Research Proposal and Scientific Writing	03.12. 321	2
2	Advanced Diagnostic Microbiology and Molecular Biology.	03.12. 322	4
3	Advanced Cellular and Molecular Immunology	03.12. 323	3
4	Advanced Medical Parasitology	03.12. 324	2
5	Thesis	03.12.333	6
Elective course MS Program (Choose one):			
7	Special Topics in Immunology and Serology	03.12. 325	3
7	Special Topics in Clinical Microbiology	03.12. 326	3
7	Special Topics in Molecular Diagnostic Microbiology	03.12. 327	3
<b>Total</b>			<b>20</b>

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### Annex-1: Program Structure:

No.	Requirements	No. of	Credit	Rational Weight %	
		Courses	Hours		
1	Program Requirements	Compulsory	12	27	77
		Elective	1	3	8
2		Thesis	1	6	15
<b>Total:</b>				36	

### Annex-2, Academic Standards Curriculum Criteria of Accreditation board.

Academic Standards:	
1	1. NARS for medical education in Yemen
2	Annex- 2, Academic Standards Curriculum Criteria of Accreditation Board
3	Annex- 3, Unified Regulations for Student Affairs, Ministry of Higher Education and Scientific Research

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Republic of Yemen

Ministry of Higher Education & Scientific Research  
21 September University for Medical & Applied Sciences  
Faculty of Laboratory medicine  
Department of Medical Microbiology and Immunology



الجمهورية اليمنية

وزارة التعليم العالي والبحث العلمي  
جامعة 21 سبتمبر للعلوم الطبية والتطبيقية  
كلية الطب المخبري

### **Annex-3, Alignment Program vision, mission and Objectives with University and Faculty**

	University	Postgraduate studies and scientific research	Faculty of laboratory Medicine Vision, Mission and Goals:	Medical Microbiology and Immunology
Vission	A contemporary university with national responsibility and a faith identity	Scientific research and contemporary postgraduate studies according to quality standards that meet the needs of the labor market locally and regionally	Contemporary and competitive faculty in Laboratory medicine.	
Mission	Leading the transformation in the management and delivery of health care with all partners by setting a standard of excellence in education and medical and applied research in a way that meets the needs of Yemeni society, its privacy and regional influence.	to prepare and implement scientific programs Qualitative application in order to prepare distinguished research leaders that contribute to the treatment of Community problems.	Contribute to improving health services in laboratory medicine by achieving standards of excellence in education and scientific research in a way that meets the needs and privacy of society and contributes to addressing global health problems.	To prepare highly qualified graduate skilled in the medical microbiology and immunology through advanced practical and conducting scientific research.

Prepared by: Dr. Gamil Taher Abdul_Mughni	Reviewed by:	Head of the Department:	Quality Assurance head	Dean:
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<p><b>Objectives</b></p>	<p>1- Ensuring the application of quality standards and setting standards of excellence in medical and applied sciences, scientific research and community service. 2. The centrality of the student in the educational process, the partnership with them for life, the consolidation of the principles of national responsibility and faith identity, their care and the development of their capabilities after graduation and during work. 3. Attracting, employing and retaining scholars, cadres and highly specialized talents to gain minds and reverse the trend of “brain drain” in a way that enhances and ensures the creation of thinkers, businessmen and good citizens. 4. Continuous development of the distinguished academic infrastructure and the establishment of modern research and service centers with high efficiency and capable of making a real impact locally and regionally.</p>	<p>1-Establishing quality postgraduate programs that attract local and regional university graduates</p> <p>2- Continuous development and updating of postgraduate programs in accordance with comprehensive quality standards</p> <p>3- Preparing distinguished researchers through continuing education programs and developing research skills. 4- Partnership with similar scientific institutions in scientific research.</p> <p>5- Developing the infrastructure, human and financial for graduate studies programs and scientific research in accordance with the standards of academic accreditation. 6- Automating the system of postgraduate studies and scientific research and activating electronic links. 7- Attracting expertise from faculty members and researchers from the internal and external environment.</p>	<p>1. Producing health science professionals and in-depth medical microbiological and immunology knowledge of different emerging infectious disease and clinical immunology. 2- Promote our students to practice health care associated infection monitoring and prevention in academic and clinical settings. 3- Provide our candidate with the ability to apply different and recent molecular biological and immunological techniques in the field of microbiology 4- Give the candidate the ability to assess immunological status in different pathological condition with gaining knowledge about immunological role in development</p> <p>1. Preparing a highly qualified and skilled cadre in the field of laboratory medicine. 2. Building an educational system that keeps pace with development and conforms to academic quality standards. 3. Adopting, supporting and investing scientific research programs to meet the requirements of sustainable development and to contribute to solving global health problems. 4. Developing a culture of community partnership in the field of laboratory medicine and research. 5. Enhancing the facility position as a preferred partner for local, regional and international partnership through implementing innovative models of education, exchanging research and knowledge and providing real and effective outcomes for developing professional practices to benefit from them locally and regionally</p>	
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5. Enhancing the university's position as a preferred partner for local, regional and international partnership through implementing innovative models of education, exchanging research and knowledge and providing real and effective outcomes for developing professional practices to benefit from them locally and regionally



of different disease and how to target by immunotherapy  
5- Provide opportunities to gain research capacity and publish scientific relevant studies.  
6. Promote community partners and stakeholders for program development, evaluation and improvement and active participation in professional societies.

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### Annex-4, Survey of Credit Hours of Similar Programs

Benchmarking		21 September University	Sana'a university	Beirut Arab University	Jordan University (JUST)	Mahidol University	University of Michigan Medical School	Umm Al-Qura University
Program Requirements	Credit Hours	28	30	24	16	15	16	29
	Percentage	77	80	67	47	42	57	
Program Electives	Credit Hours	3	0	6	9	9	5	0
	Percentage	8	-	17	26	25	18	
Program Thesis	Credit Hours	6	6	6	9	12	7	
	Percentage	15	20	17	26	33	25	
Total Credit Hours		36	36	36	34	36	28	29

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Prepared by: Dr. Gamil Taher Abdul_Mughni	Reviewed by:	Head of the Department:	Quality Assurance head	Dean:
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**Annex-5, Survey on Mission and objectives of the program and Similar accredited program.**

University	21 September	Sana'a university	Beirut Arab University	Jordan University (JUST)	Mahidol University	University of Michigan	Umm Al-Qura University
Faculty	Laboratory Medicine	Faculty of medicine	Health Sciences	Applied Medical Sciences	FACULTY OF SCIENCE SIRIRAJ HOSPITAL		Medicine
Department	Medical Microbiology & Immunology	Medical microbiology	Medical Laboratory Technology	Medical Laboratory Sciences	Department of Microbiology	Department of Microbiology and Immunology	Department of Microbiology
Program	Medical Microbiology & Immunology	degree program in medical microbiology	Medical Laboratory Scs - Microbiology and Immunology	Master Degree in Medical Laboratory Sciences/Clinical Microbiology, Immunology and Serology	CLINICAL MICROBIOLOGY AND LABORATORY MANAGEMENT		M.Sc. Medical Microbiology
Country	Yemen,	Yemen,	Lebanon	Jordan	Bangkok, Thailand	USA	KSA

<p><b>Program Mission</b></p>	<p>To prepare highly qualified graduate skilled in the medical microbiology and immunology through advanced practical and conducting scientific research.</p>	<p>to contribute to improve health in Yemen, through the pursuit of excellence in research, postgraduate teaching, and advanced training</p>	<p>prepared to work in healthcare organizations ranging from private laboratories, hospitals, clinics, pharmaceutical companies, health assurance units, and infection control teams and Ministry of public health.</p>	<p>It is designed to provide students with in-depth updated knowledge in the respective fields, enhance students' critical thinking and problem solving abilities, introduce them to scientific research, and provide them the opportunity to apply their skills and knowledge in designing and conducting scientific research studies.</p>	<p>to produce graduates that have the ability to integrate knowledge in the fields of Microbiology, Immunology, Cell and Molecular Biology, and Bioinformatics and apply their knowledge and skills in teaching and/or conducting international standard laboratory experiments independently.</p>	<p>To conducting medical and scientific research, training the next generation of scientists, teaching the University's student body, and serving the medical school, the scientific community and the public.</p>
<p><b>Program Objectives (PObj)</b></p>	<p>1- Produce health science professionals and in-depth medical microbiological and immunology knowledge of different emerging infectious disease and clinical immunology. 2- Promote our students to practice health</p>		<p>to prepare postgraduates for leadership and managerial roles in the clinical laboratory and professional organizations with a competitive edge in a rapidly changing and dynamic profession</p>	<p>It is designed to provide students with in-depth updated knowledge in the respective fields, enhance students' critical thinking and problem solving abilities, introduce them to scientific research, and provide them the opportunity to apply their skills and knowledge in designing and conducting scientific research studies.</p>	<p>PEO 1: Work conscientiously with professional integrity and ethical standards. PEO 2: Possess conceptual knowledge of Microbiology, Immunology and other related subjects. PEO 3: Solve research problems using analytical skills and appropriate techniques in the fields of Microbiology and</p>	

	<p>care associated infection monitoring and prevention in academic and clinical settings.</p> <p>3- Provide our candidate with the ability to apply different and recent molecular biological and immunological techniques in the field of microbiology</p> <p>4- Give the candidate the ability to assess immunological status in different pathological condition with gaining knowledge about immunological role in development of different disease and how to target by immunotherapy</p> <p>- Provide opportunities to gain research capacity and publish scientific relevant studies.</p>				<p>Immunology.</p> <p>PEO 4: Conduct independent scientific research and work as part of a team.</p> <p>PEO 5: Analyze and process scientific data using appropriate statistical tools, and effectively convey the data using information and communication technologies.</p>		
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	6. Promote community partners and stakeholders for program development, evaluation and improvement and active participation in professional societies.						
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**Annex-6, Alignment Program Intended Learning Outcomes (PILOs) to Faculty Educational Objectives (FObj).**

1. Program PILOs	Goals Objectives				
	FObj1	FObj2	FObj3	FObj4	FObj5
A1	√	√	√	√	√
A2	√	√	√	√	√
A3	√	√	√	√	√
A4	√	√	√	√	√
B1	√	√	...	√	√
B2	√	√	...		
B3	√	√	...		
B4	√	√	√		
B5	√	√	√	...	
C1	√	√	√	...	
C2	√	√	√	...	
C3	√	√	√		√
C4	√	√	√	√	
D1	√	√	√		√
D2	√	√	√		√
D3	√	√	√		√

**Annex-8, Alignment of Program Intended Learning Outcomes (PILOs) to Program Objectives (POs)**

1. Program PILOs	Program Objectives					
	PObj1	PObj2	PObj3	PObj4	PObj5	PObj6
A1	√	√	...	...	√	
A2	√	√	...	√	√	
A3	√	√	√	√	√	√
A4	√	√	√	√	√	√
B1	√	√	...	√	√	√
B2	√	√	...	√		√
B3	√	√	...	√		√
B4	...	√	√	√	√	√
C1	√	√	...	...	√	√
C2	...	...	...	...	√	√
C3	...	...	...	√	√	√
C4	√	√	...	√		
D1	√	√	√	√	√	√
D2	√	√	...	√	√	√
D3	√	√	√	√	√	√

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Annex-4, Survey of Credit Hours of Similar Programs							
Benchmarking		University of 21 September	Sana'a university	Beirut Arab University	Jordan University (JUST)	Mahidol University	University of Michigan Medical School
Program Requirements	Credit Hours	28	30	24	16	15	16
	Percentage	77	80	67	47	42	57
Program Electives	Credit Hours	3	0	6	9	9	5
	Percentage	8	-	17	26	25	18
Program Thesis	Credit Hours	6	6	6	9	12	7
	Percentage	15	20	17	26	33	25
Total Credit Hours		36	36	36	34	36	28

**Annex-11 , Survey of Course Names per Academic Semesters of Similar Programs**

University	University of 21 September for Applied & Medical Sciences	Sana'a university	Beirut Arab University	Jordan University of Science and Technology (JUST)	Mahidol University	University of Michigan
No of Courses	13	13	11			
Total Cr. Hrs.	36	36	36	34	36	28

**Level 1**

Semester	No	Course Name	Course Name	Course Name	Course Name	Course Name	Course Name
1	1	Advanced Molecular Biology	Molecular biology I and II	Laboratory Quality Management and Accreditation	INDEPENDENT STUDY	Research Ethics	
	2	Advanced Biostatistics and Epidemiology	Epidemiology	Biomedical Laboratory Techniques	ADVANCED BIostatISTICS AND COMPUTER APPLICATION	Cell Science	
	3	Advanced Medical Bacteriology	Medical Bacteriology I and II	Advanced Clinical Laboratory Microbiology	MOLECULAR AND CELLULAR PATHOGENESIS	Generic Skills In Science Research	
	4	Advanced Immunology	Medical Parasitology	Advanced Clinical Laboratory Bacteriology	ADVANCED BIOCHEMISTRY	Immunology	

	5	Advanced Medical Parasitology	Biostatistics		ADVANCED BIOCHEMISTRY	Microbiology	
	6	Advanced Medical Virology	Tutorial session		ADVANCED MOLECULAR BIOLOGY	Current Topics In Immunology	
	7	Advanced Medical Mycology			ADVANCED MEDICAL MICROBIOLOGY AND IMMUNOLOGY	Current Topics In Bacteriology And Mycology	
	8	Seminar			ADVANCED DIAGNOSTIC MICROBIOLOGY PRACTICAL TRAINING 1	Current Topics In Virology	
		Total			ADVANCED DIAGNOSTIC MICROBIOLOGY PRACTICAL TRAINING II	Current Topics In Parasitology	
2	1	Research Methods, Research Proposal and Scientific Writing	Advanced medical virology I and II	Research Methodology and Scientific Writing	ADVANCED CLINICAL LABORATORY MANAGEMENT	Special Topics In Microbiology And Immunology	
	2	Advanced Diagnostic microbiology	Advanced immunology I and II	Medical Statistics	SEMINAR	Microbiology And Immunology Seminar	
	3	Advanced Cellular and Molecular Immunology	Diagnostic microbiology I,II,III	Seminars in Specialized Topics	ADVANCED CLINICAL LABORATORY TRAINING	Special Topics In Microbiology And Immunology li	

4	Advanced Molecular diagnostic microbiology	Mycology	Advanced Clinical Laboratory Immunology		Microbiology And Immunology Seminar Ii	
	Journal Club	Food and water microbiology	Thesis			
	Thesis	Seminar				
	ELECTIVE COURSE MS Program (Choose one):	Thesis			thesis	
	Special Topics in Immunology and Serology		Major Elective Courses (MEC)	ADVANCED CLINICAL MICROBIOLOGY AND IMMUNOLOGY I	Elective Courses	
	Special Topics in Clinical Microbiology		Advanced Clinical Chemistry	ADVANCED CLINICAL MICROBIOLOGY AND IMMUNOLOGY II	Biostatistics	
	Special Topics in molecular diagnostic Microbiology		Microbial Pathogenesis and Infectious Diseases	ADVANCED CLINICAL MICROBIOLOGY AND IMMUNOLOGY III	Cell And Molecular Biology	
	Total		Infection Control	SPECIAL TOPICS IN IMMUNOLOGY AND SEROLOGY	Immunological Methods	
	0		Immunotherapy and	SPECIAL TOPICS IN CLINICAL	Gene Technology	

				vaccination	MICROBIOLOGY		
				Molecular Laboratory Diagnosis		Animal Cell Culture Techniques	
				Cell Therapy and Regenerative Medicine		Molecular Microbiology	
				Evidence Based Practice		Molecular Sequence Analysis	
						Techniques In Microbiological/Immunological Research	
						Thesis Credit	
						Thesis	

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**Annex-12, Survey of Number of courses and Credit Hours of Similar Programs Compared to Current Program**

University	No of Courses	Total Cr. Hrs.
University of 21 September for Medical & Applied Sciences	13	36
Faculty of medicine Sana'a university	13	30
Beirut Arab University	11	36
Jordan University of Science and Technology (JUST)	25	34
Mahidol University	25	36
University of Michigan		28

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**Annex-13 , Matrix of Mapping Program PILO's with Courses**

Course	No.	Code/ No.	ILOS														
			Knowledge & understanding skills				Intellectual skills				Practical & professional skills				General & Transferable skills		
			A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3
1	Advanced Molecular Biology		x	x	x	x					x	x	x	x	x	x	x
2	Advanced Biostatistics and Epidemiology		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Advanced Medical Bacteriology		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4	Advanced Immunology		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

5	Advanced Medical Parasitology	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
6	Advanced Medical Virology	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
7	Advanced Medical Mycology	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
8	Research Methods, Research Proposal and Scientific Writing	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
9	Advanced Diagnostic Microbiology	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
10	Advanced Molecular Immunology and Immunogenetics	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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11	Advanced Molecular Diagnostic Microbiology		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
12	Thesis		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
13	ELECTIVE COURSE (Choose one)		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
I	Special Topics in Immunology and Serology		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
II	Special Topics in Clinical Microbiology		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
III	Special Topics in Molecular Diagnostic Microbiology		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x