Course Specifications

Revised November 2019

Course Title:	**Molecular Microbiology**
Course Code:	**4013462-3**
Program:	**BSc Microbiology**
Department:	**Biology**
College:	**Faculty of Applied Science**
Institution:	**UM AL – QURA UNIVERSITY**

Table of Contents

A. Course Identification

1. Credit hours:	3 hours
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ■ Elective ☐
3. Level/year at which this course is offered:	3rd year/ Level 6
4. Pre-requisites for this course (if any)**:**	Introductory Microbiology (4012401-4)
5. Co-requisites for this course (if any)**:**	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	30	50 %
2	**Blended**		-
3	**E-learning**		-
4	**Correspondence**		-
5	**Other**	30	50 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	42
3	**Tutorial**	-
4	Practical/Field work/Internship	6
5	**Others** (specify)	30
	Total	102
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	8
3	**Library**	15
4	**Projects/Research Essays/Theses**	10
5	**Others** (specify)	-
	Total	63

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The molecular biology course is about genes - their structure and function - therefore; students will learn nucleic acid structure and the mechanism of DNA replication, DNA repair, transcription, and translation in prokaryotic and eukaryotes. A central goal is to understand gene regulation at all levels, and the structure-function relationships of nucleic acids and proteins. In addition, critical experiments will be performed in the laboratory to learn how our current understandings have come about. Techniques in molecular biology will be discussed in lecture as necessary to understand experiments and concepts.

2. Course Main Objective

❖ **After completing this course student should be able to:**

- Identify molecular biology, molecular microbiology
- Aware with Genetic engineering and its application.
- List the genetic material in microorganisms
- Differentiate between the genetic material in Eukaryote and Prokaryotic cells
- Describe genetic material and DNA structure.
- Differentiate between DNA and RNA as the genetic material.
- Describe the Gene concept at the molecular level.
- List the steps of Central Dogma
- Understand DNA replication process
- Aware with RNA structure , types and Transcription
- Identify the Genetic code
- Describe Regulation of Gene expression
- Identify what is the Mutations, types, methods for mutations
- Describe Functional Genomics, Proteomics
- Aware with restriction enzymes
- Describe Design primers
- Aware with Bioinformatics and it's important to process the biological data
- Understand the theory for Gel electrophoresis for DNA and proteins
- Describe what the gene libraries are?
- Understand the role of Polymerase Chain Reaction (PCR) in molecular biology.
- Understand DNA sequencing and analysis.
- Explain why proteins could not synthesize without transcription step.
- Differentiate between Genome, Transcription, and Proteome
- Explain how the mutation occurred

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
	❖ **After completing this course student should be able to:** • Identify molecular biology, molecular microbiology • Aware with Genetic engineering and its application. • List the genetic material in microorganisms • Differentiate between the genetic material in Eukaryote and Prokaryotic cells • Describe genetic material and DNA structure. • Differentiate between DNA and RNA as the genetic material. • Describe the Gene concept at the molecular level.	

	CLOs	Aligned PLOs
	• List the steps of Central Dogma • Understand DNA replication process • Aware with RNA structure , types and Transcription • Identify the Genetic code • Describe Regulation of Gene expression • Identify what is the Mutations, types, methods for mutations • Describe Functional Genomics, Proteomics • Aware with Bioinformatics and it's important to process the biological data • Understand the theory for Gel electrophoresis for DNA and proteins • Describe what the gene libraries are? • Understand the role of Polymerase Chain Reaction (PCR) in molecular biology. • Understand DNA sequencing and analysis. • Explain why proteins could not synthesize without transcription step. • Differentiate between Genome, Transcription, and Proteome • Explain how the mutation occurred	
2	**Skills:**	
2.1	**Cognitive skills to be developed** • Having successfully completed the course students should be able to: • Explain why the molecular microbiology important in our life is? • Differentiate between the genetic material in Eukaryote and Prokaryotic cells • Describe genetic material and DNA structure. • Differentiate between DNA and RNA as the genetic material. • Describe the Gene concept at the molecular level. • Understand the role of each steps in Central Dogma • Understand DNA replication process • Understand how the proteins synthesized • Describe Regulation of Gene expression • Describe Functional Genomics, Proteomics • Understand the principle theory for Gel electrophoresis for DNA and proteins. • Describe what the gene libraries are? • Understand the role of Polymerase Chain Reaction (PCR) in molecular biology. • Understand DNA sequencing and data analysis. • Explain why proteins could not synthesize without transcription step. • Differentiate between Genome, Transcription, and Proteome • Explain how the mutation occurred • Aware with restriction enzymes • Describe Design primers	
2.2.	**Psychomotor Skills** ❖ Upon successful completion of this course, the student is expected to be able to:	

	CLOs	Aligned PLOs
	• Perform the laboratory experiments precisely • Operate all devices in molecular microbiology lab • Prepare lab solutions and reagent. • Understanding instructions and operate DNA equipment • Use computer and internet to search the latest information in DNA.	
3	**Competence:**	
3.1	❖ Upon successful completion of this course, the student is expected to be able to: • Aware with molecular microbiology and Genetic engineering and its application in our life. • Developing oral presentations. • Communicating personal ideas and thoughts. • Work independently and as part of a team to finish some assignments. • Communicate results of work to others. • Demonstrate professional attitudes and behaviors towards others. • Propose the smart questions • Understand and dissecting the problem so that it is fully solved understood. • Demonstrate the assertiveness for his decision. • Demonstrate his capability for the responsibility and Accountability • Show Effective verbal communication with clarity and must be characterize with the following interpersonal attributes; (verbal communication, Non-verbal communication, good listening for the others, questioning, good manners, problem solving, Social awareness,self-management, responsibility and accountability) • Enhancing the ability of students to use computers and internet. • Interpret the laboratory data. • Know how to write a report.	

C. Course Content

No	List of Topics	Contact Hours
1	Syllabus review, study skills review Introduction to Molecular Biology	2
2	Central Dogma DNA structure DNA replication RNA structure , types and Transcription Genetic code Translation Regulation of Gene expression Mutations Functional Genomics, Proteomics Introduction to Bioinformatics	2
3	DNA structure	2
4	DNA replication	2

5	RNA structure , types and Transcription	2
6	Genetic code	4
7	Translation	1
8	Regulation of Gene expression	2
9	Mutations	4
10	Functional Genomics, Proteomics	4
11	Introduction to Bioinformatics	3
Total		**28h**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	❖ **After completing this course student should be able to:** • Identify molecular biology, molecular microbiology • Aware with Genetic engineering and its application. • List the genetic material in microorganisms • Differentiate between the genetic material in Eukaryote and Prokaryotic cells • Describe genetic material and DNA structure. • Differentiate between DNA and RNA as the genetic material. • Describe the Gene concept at the molecular level. • List the steps of Central Dogma • Understand DNA replication process • Aware with RNA structure , types and Transcription • Identify the Genetic code • Describe Regulation of Gene expression • Identify what is the Mutations, types, methods for mutations • Describe Functional Genomics, Proteomics • Aware with Bioinformatics and it's important to process the biological data • Understand the theory for Gel electrophoresis for DNA and proteins • Describe what the gene libraries are? • Understand the role of Polymerase Chain Reaction (PCR) in molecular biology. • Understand DNA sequencing and	-Themethodology includes a combination of lectures by the lecturer, seminar presentation by the students and web-interactions. -At the end of the programme, students will be divided into groups for seminar presentation on important areas of the course to assess their understanding and comprehension of the course. -All students will be involved in on-line learning process and each student is required to create an E-mail address to facilitate student web interactions. Using images and movies -Encouraging students to collect the new information about what the new in Molecular microbiology. -Availability of the reference books and scientific sites concerning Molecular microbiology.	• Periodical exam and reports 10% • Mid- term theoretical exam 20% • Mid-term practical exam 5% • Final practical exam 15% • Final exam 50%

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	analysis. • Explain why proteins could not synthesize without transcription step. • Differentiate between Genome, Transcription, and Proteome Explain how the mutation occurred		
2.0	**Skills**		
2.1	**Cognitive skills to be developed** • Having successfully completed the course students should be able to: • Explain why the molecular microbiology important in our life is? • Differentiate between the genetic material in Eukaryote and Prokaryotic cells • Describe genetic material and DNA structure. • Differentiate between DNA and RNA as the genetic material. • Describe the Gene concept at the molecular level. • Understand the role of each steps in Central Dogma. • Understand DNA replication process • Understand how the proteins synthesized. • Describe Regulation of Gene expression • Describe Functional Genomics, Proteomics • Understand the principle theory for Gel electrophoresis for DNA and proteins. • Describe what the gene libraries are? • Understand the role of Polymerase Chain Reaction (PCR) in molecular biology. • Understand DNA sequencing and data analysis. • Explain why proteins could not synthesize without transcription step. • Differentiate between Genome, Transcription, and Proteome • Explain how the mutation occurred . • Aware with restriction enzymes • Describe Design primers	• Lectures. • Brain storming. • Discussion.	• Exam must contain questions that can measure these skills. • Quiz and exams. • Discussions after the lecture.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	**P Psychomotor Skills** • Upon successful completion of this course, the student is expected to be able to: • Perform the laboratory experiments precisely • Operate all devices in molecular microbiology lab • Prepare lab solutions and reagent. • Understanding instructions and operate DNA equipment • Use computer and internet to search the latest information in DNA.	- Follow up students the students in lab and during carryout all the laboratory experiments	-Giving additional marks for the students they have accurate laboratory results and good seminar presentation -Practical exam.
3.0	**Competence**		
	• Upon successful completion of this course, the student is expected to be able to: • Aware with molecular microbiology and Genetic engineering and its application in our life. • Aware with restriction enzymes, and aware with how design primers, gene cloning. • Developing oral presentations. • Communicating personal ideas and thoughts. • Work independently and as part of a team to finish some assignments. • Communicate results of work to others. • Demonstrate professional attitudes and behaviors towards others. • Propose the smart questions • Understand and dissecting the problem so that it is fully solved understood. • Demonstrate the assertiveness for his decision. • Demonstrate his capability for the responsibility and Accountability • Show Effective verbal communication with clarity and must be characterize with the following interpersonal attributes; (verbal communication, Non-	- Lab work - Case Study - Active learning - Small group discussion - Homework (preparing a report on some topics related to the course depending on web sites). - Seminars presentation - Practical during carryout the experiments in the lab.	- Oral exams. - Evaluate the efforts of each student in preparing the report. - Evaluate the scientific values of reports. - Evaluate the work in team - Evaluation of the role of each student in lab group assignment - Evaluation of students presentations

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	verbal communication, good listening for the others, questioning, good manners, problem solving, Social awareness,self-management, responsibility and accountability) • Enhancing the ability of students to use computers and internet. • Interpret the laboratory data. • Know how to write a report.		

2. Assessment Tasks for Students

5. Schedule of Assessment Tasks for Students During the Semester

Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Exam duration	Proportion of Final Assessment
1	**Periodical Exam (s)**	**4**	**15 min**	**10 %**
2	**Mid Term Exam (Theoretic)**	**8**	**60 min**	**20 %**
3	**Mid Term Exam (practical)**	**9**	**30 min**	**10 %**
4	**Reports and essay**	**11**	**--**	**5 %**
5	**Final Practical Exam**	**15**	**60 min**	**15 %**
6	**Final Exam**	**16**	**120 min**	**40 %**
			Total Marks	**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Office hours: 10hrs.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Allison, L. A. (2008): Fundamental Molecular Biology. 2nd edition, Wiley-Blackwell Ltd.; Malden, MA, USA.
Essential References Materials	Weaver R. F. (2008). Molecular Biology. McGraw Hill Higher Education; 4th edition
Electronic Materials	https://www.coursera.org/ https://www.edx.org

Other Learning Materials	Microsoft office package. Multi-media associated with the text book and the relevant websites. PPT prepared by Prof. Dr. Gamal Haridy

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Prepared lecture hall with audio –visual aids. • Equipped laboratory with DNA facilities.
Technology Resources (AV, data show, Smart Board, software, etc.)	• Digital lab containing 15 computers.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Incubators, autoclaves, measuring equipment, water bath, digital balances, pH meters, safety facilities, PCR, centrifuge, All PCR kits, RNA, DNA extraction kits. • All culture media, chemical, reagents needed. • Electrophoresis units for DNA and Protein • Biofuge, Vortex.

G. Course Quality Evaluation

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching
- **Questionaries**
- **Open discussion in the class room at the end of the lectures.**

2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department
- **Revision of student answer paper by another staff member.**
- **Analysis the grades of students.**

3. Processes for Improvement of Teaching
- **Preparing the course as PPT.**
- **Using scientific movies.**
- **Coupling the theoretical part with laboratory part**
- **Periodical revision of course content.**

4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)
- **After the agreement of Department and Faculty administrations**

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.
- **Periodical revision by Quality Assurance Units in the Department and institution**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Prepared by faculty staff: Prof. Dr. Gamal Haridy	**Signature:**

Date Report Completed: November **2019**	
Revised by: 1. Prof. Dr. Khaled Elbanna 2. Dr. Hussein H. Abulreesh 3. Prof. Dr. Shady Elshahawy	**Signature:**
Date: November **2019**	
Program Chair Dr. Hussein H. Abulreesh	**Signature:**
Dean	**Signature:**
Date:	