Course Specifications

Revised November 2019

Course Title:	**Bioinformatics**
Course Code:	**4014182-2**
Program:	**BSc Microbiology**
Department:	**Biology**
College:	**Faculty of Applied Science**
Institution:	**UMM AL – QURA UNIVERSITY**
Revision Date	**November 2019**

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A. Course Identification

1. Credit hours:	**2 hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ■ Elective ☐
Level/year at which this course is offered:	**4th Year / Level 8:**
4. Pre-requisites for this course (if any)**:**	**Biotechnology (4014401-3)**
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	28
2	Laboratory/Studio	-
3	Tutorial	-
4	Practical/Field work/Internship	6
5	Others (specify)	30
	Total	64
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

This course studies about many useful things from internet to analyze molecular biology informations used in microbiological fields. They are datas from gene Bank, database structure, DNA sequencing analysis, methods for DNA sequence prediction and protein informations, also the use of many application programs that related to bioinformatics. Several application aspects and bioinformatics historical development also introduced. After taking this course, students are expected to understand about the use of internet to obtain gene bank database and entry DNA sequencing data to the gene bank. Students are expected to operate many application programs to search and analyze data, and to predict the biological function of DNA and protein sequences.

2. Course Main Objective

❖ **After completing this course student:**

- Will become familiar with all information about Bioinformatics
- Will aware with Methods, and tools used in Bioinformatics
- Will be able to search and retrieve information from genomic and proteomic databases (GenBank), and to analyze their search results using software available on the internet (e.g. BLAST, ClustalW).
- Will be describe how to compare and analyze biological sequences and how to interpret the results of their analyses. Students will learn how to construct phylogenetic trees based on biological sequence data.
- Will be able to perform elementary predictions of DNA and protein structure and function.
- Will be able to use of computers to collect, analyze, and interpret biological information at the molecular level
- Will be able to computer (algorithms) to gain novel biological knowledge.
- Will be able to use biological knowledge to construct algorithms (DNA & protein sequence databases ,Sequence similarity, alignment, & assembly, Sequence patterns/motifs, Phylogenetic, Microarray gene expression data, Protein structure prediction, Mapping metabolic and regulatory pathways (graph theory).

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
	❖ Having successfully completed the course students should be able to: • Define Bioinformatics, phylogenetic, Genome mapping, restriction map..etc. • List the Methods and tools used in Bioinformatics. • List applications of bioinformatics in different biological fields. • Familiar with different database for DNA and protein. • Familiar with different RNA sequence analysis.	

	CLOs	Aligned PLOs
	• Understanding three dimension protein structures. • Aware with knowledge to make DNA alignment and comparison. • Aware with knowledge to make protein alignment and comparison. • Aware with knowledge to designing primer or synthetic genes. • Familiar with different database for DNA and protein.	
2	**Skills:**	
2.1	**Cognitive skills to be developed** ❖ Having successfully completed the course students should be able to: • Use of computers to collect, analyze, and interpret biological information at the molecular level. • Describe the know how to design primers, • Describe the know how to construct phylogenetic trees trees based on biological sequence data. • Describe the know how to searching about genes, organisms in Gene Bank Data Base. • Use the bioinformatics to design and discovering new drugs • Students will be able to search and retrieve information from genomic and proteomic databases (GenBank), and to analyze their search results using software available on the internet (e.g. BLAST, ClustalW). • Describe how to compare and analyze biological sequences • Describe how to interpret the results of their analyses. Students will learn how to construct phylogenetic trees based on biological sequence data. • Predict with DNA and protein structure and their functions. • The students will be able to computer (algorithms) to gain novel biological knowledge. • Use biological knowledge to construct algorithms (DNA & protein sequence databases ,Sequence similarity, alignment, & assembly, Sequence patterns/motifs, Phylogenetic, Microarray gene expression data, Protein structure prediction, Mapping metabolic and regulatory pathways (graph theory). • Explain the uses of different programs for data analysis • Understand the role and importance of bioinformatics in biological sciences.	
2.2.	**Psychomotor Skills** ❖ Upon successful completion of this course The student will be able to: • Practice the basic bioinformatics programs and Skills • Prepare different phylogenetic tree and analyzing data.	
3	**Competence:**	

CLOs		Aligned PLOs
	❖ Upon successful completion of this course The student will be able to: • 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. • Use of computers to collect, analyze, and interpret biological information data at the molecular level. • 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 bioinformatic data. • Know how to write a report.	

C. Course Content

1 Topics to be Covered		
List of Topic	No of Weeks	Contact hours
❖ Bioinformatics databases (**Introduction**)	**1**	**2**
Bioinformatics databases (Nucleotide sequence databases)	**1**	**2**
❖ **Bioinformatics databases (Protein sequence databases)**	**1**	**2**
Bioinformatics databases (Sequence motif databases)	**1**	**2**
Bioinformatics databases (Protein structure databases)	**1**	**2**
Bioinformatics databases (Other relevant databases)	**1**	**2**
Alignment (Types of divergence and Conserved regions)	**1**	**2**
❖ **Alignment (Structure alignment)**	**1**	**2**
❖ **Alignment (Insertion/deletion scores), Alignment (Database search)**	**1**	**2**
❖ **Alignment (Multiple alignment), Alignment (Similarity and Homology)**	**1**	**2**
❖ **Alignment (Matching algorithms)**	**1**	**2**
❖ **Alignment (Searching 3D Databases)**	**1**	**2**
❖ **Alignment (Classifying 3D shapes)**	**1**	**2**
❖ **Designing (primer, synthetic gene, protein affinity and specificity)**	**1**	**2**
Total learning weeks and Contact hours	**14 weeks**	**28hrs**

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	❖ Having successfully completed the course students should be able to: • Define Bioinformatics, phylogenetic, Genome mapping, restriction map..etc • List the Methods and tools used in Bioinformatics • List applications of bioinformatics in different biological fields • Familiar with different database for DNA and protein • Familiar with different RNA sequence analysis • Understanding three dimension protein structures • Aware with knowledge to make DNA alignment and comparison. • Aware with knowledge to make protein alignment and comparison. • Aware with knowledge to designing primer or synthetic genes. • Familiar with different database for DNA and protein.	• Lectures which must start with preliminary one showing course contents • Using images and movies • Studying tools of bioinformatics • Encouraging student to collect the new information about different bioinformatics. • Enable the reference books and scientific sites concerning bioinformatics in internet.	• Periodical exam and reports 20% • Mid- term theoretical exam 25% • Final exam 55%
2.0	**Skills**		
2.1	**Cognitive skills** ❖ Having successfully completed the course students should be able to: • Use of computers to collect, analyze, and interpret biological information at the molecular level • Describe the know how to design primers, synthetic genes. • Describe the know how to	• Through lectures, videos and some bioinformatics programs introduced to the students to enable them to understand how the run sequences analysis and comparison	Exam must contain questions that can measure these skills.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	construct phylogenetic trees trees based on biological sequence data. • Describe the know how to searching about genes, organisms in Gene Bank Data Base. • Use the bioinformatics to design and discovering new drugs • Students will be able to search and retrieve information from genomic and proteomic databases (GenBank), and to analyze their search results using software available on the internet (e.g. BLAST, ClustalW). • Describe how to compare and analyze biological sequences • Describe how to interpret the results of their analyses. Students will learn how to construct phylogenetic trees based on biological sequence data. • Predict with DNA and protein structure and their functions. • The students will be able to computer (algorithms) to gain novel biological knowledge. • Use biological knowledge to construct algorithms (DNA & protein sequence databases ,Sequence similarity, alignment, & assembly, Sequence patterns/motifs, Phylogenetic, Microarray gene expression data, Protein structure prediction, Mapping metabolic and regulatory pathways (graph theory). • Explain the uses of different programs for data analysis. • Understand the role and importance of bioinformatics in biological sciences.	fixation process.	
2.2	**Psychomotor Skills** ❖ Upon successful completion of this course The student will be able to: • Practice the basic	• Follow up students to analyze biological data in the computer lab.	• Giving additional marks for the students they have accurate biological data analysis

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	bioinformatics programs and Skills • Prepare different phylogenetic tree and analyzing data.		•
3.0	**Competence**		
3.1	❖ Upon successful completion of this course The student will be able to: • 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. • Use of computers to collect, analyze, and interpret biological information at the molecular level. • 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 bioinformatics data. • Know how to write a report.	• 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	• 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.

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 (Application)**	**9**	**30 min**	**10 %**
4	**Reports and essay**	**11**	**--**	**5 %**
5	**Final Application 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	• Course note and PPT prepared by faculty member responsible for the course: Prof. Dr. Gamal Haridy Osman
Essential References Materials	**Required Text(s):** • (1)- Bioinformatics Algorithms: An Active Learning Approach (Paperback) by Phillip Compeau (Goodreads Author) (shelved 3 times as *bioinformatics*) avg rating 5.00 — 55 ratings — published 2014 • (2)- Understanding Bioinformatics (Paperback) by Market Zvelebil (shelved 3 times as *bioinformatics*) avg rating 3.45 — 71 ratings — published 2007 • (3)- Sequence Alignment: Methods, Models, Concepts, and Strategies (Hardcover) by Michael S. Rosenberg (Goodreads Author) (Editor) (shelved 3 times as *bioinformatics*) • (4)- Computational Molecular Biology: An Algorithmic Approach (Hardcover) by Pavel A. Pevzner (shelved 1 time as *bioinformatics*) avg rating 3.33 — 23 ratings — published 2000 • (5)- Introduction to Bioinformatics (Paperback) by Arthur M. Lesk (shelved 7 times as *bioinformatics*) avg rating 3.75 — 159 ratings — published 2002
Electronic Materials	• **PPT prepared by prof. Dr. Gamal Haridy Osman**

Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Availability of some bioinformatics programs • Availability of some biostatistical analysis programs
Technology Resources (AV, data show, Smart Board, software, etc.)	• Digital classroom containing 15 computers supplemented with bioinformatics programs.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Digital classroom containing 15 computers.

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: 1. Prof. Dr. Gamal Haridy Osman	**Signature:**
Date Report Completed: November 2019	
Revised by:	**Signature:**

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