Course Specification
(Postgraduate)

Introduction to Bioinformatics and Computational Biology
Course Code: 373521-4
Program: Master of Clinical Laboratory Sciences in Molecular Diagnostics
Department: Clinical Laboratory Sciences
College: Applied medical Sciences
Institution: Taif University
Version: No 3
Last Revision Date: 18/01/2024

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (4 hrs.)				
2. Course type				
A.	☐ University	☐College	☒ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (4th level/2nd t year)				
4. Course general Description:				
This course introduces students to the fundamental theories and practices of Bioinformatics and Computational Biology via a series of integrated lectures and practices. It will focus on the basic knowledge required in this field, methods of data generation, accessing public genome-related information data, and tools for data mining and analysis				
5. Pre-requirements for this course (if any)**:**				
None				
6. Pre-requirements for this course (if any)**:**				
373501-3				
7. Course Main Objective(s):				
At the end of this course students will: **• Understand the increasing necessity for computation in modern life sciences research.** **• Be able to use and evaluate online bioinformatics resources including major biomolecular and genomic databases, search and analysis tools, genome browsers, structure viewers, and select quality control and analysis tools to solve problems in the biological sciences.** **• Understand the process by which genomes are currently sequenced and the bioinformatics processing and analysis required for their interpretation.** **• Be familiar with the research objectives of the bioinformatics related sub-disciplines of Genomics, Transcriptomics and Proteomics. In short, students will develop a solid foundational knowledge of bioinformatics and be able to evaluate new biomolecular information using existing bioinformatic tools and resources.**				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	40	100%
2	E-learning	N/A	0
3	Hybrid	N/A	0

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning	N/A	0
5	Others	N/A	0

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	60
2.	**Laboratory/Studio**	N/A
3.	**Field**	N/A
4.	**Tutorial**	N/A
5.	**Others (specify)……**	N/A
	Total	60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth understanding of bioinformatics that covers principles, concepts, theories; databases and tools related to the field.	K1	Lectures	Report
1.2	Explain different molecular techniques that are used for management, development and innovation of molecular therapy and treatments	K2	Lectures, Problem based learning	- Group Discussion - Exam
2.0	**Skills**			
2.1	Apply bioinformatics analysis to genome, transcriptome,	S1	Interactive Lecture	Scientific Activity

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	proteome and metabolome areas.			
2.2	Utilize various available digital biological databases to extract relevant information	S2	Group discussions	- Group Discussion - Exam
2.2	Perform basic research using bioinformatics tools and techniques. .	**S3**	Problem Based Learning	• Report Scientific Activity
3.0	**Values, autonomy, and responsibility**			
3.1	Exhibit professional and ethical attitude while dealing with biological information and digital tools.	V1	Group discussions	Group Discussion

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction to Bioinformatics and Basic Concepts • • Introduction • • Major Biological Databases • • Basic Problems in Bioinformatics • • Related Fields and Applications	**4**
2.	Sequence Alignment • • Local and Global Alignment • • Pairwise and Multiple-Sequence Alignment	**4**
3.	Sequence Alignment • • Tools Used in Sequence Alignment • • Penalties in Scoring Alignment • • Scoring Algorithm	**4**
4.	Sequence Homology • • Evolutionary, Functional and Structural Relationships	**4**
5.	Phylogenetic Analysis, Genome Browser and Primer Designing • • Phylogeny Tree Construction • • BLAST Primer	**4**

6.	Mutation Analysis • • Genetic Variants	**4**
7.	Predictive Biology • • Protein Function and Structure Prediction	**4**
8.	Molecular Docking	**4**
9.	Advances and Limitations; and Ethics in Bioinformatics	**4**
Total		**40**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments (Practical Reports)	Throughout semester	40%
2.	Activity (Research Articles)	10th Week	20%
3.	Final Evaluation (Report of the Gene)	19th week	40%
	Total		100%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	- Noor Ahmad Shaik, Khalid Rehman, Hakeem Babajan Banaganapalli, Ramu Elango. **Essentials of Bioinformatics,Volume I. Understanding Bioinformatics: Genes to Proteins** ISBN 978-3-030-02633-2 ISBN 978-3-030-02634-9 (eBook) https://doi.org/10.1007/978-3-030-02634-9 Library of Congress Control Number: 2019930435 © Springer Nature Switzerland AG 2019 M. Zvelebil and J. O. Baum, Understanding Bioinformatics, Garland Science, 2008.
Supportive References	N/A
Electronic Materials	NCBI & EBI resources. Database searching with BLAST PSI-BLAST, Profiles and HMMs Software for analysis of RNA-Seq data

Other Learning Materials	N/A

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Data show and Blackboard
Other equipment (Depending on the nature of the specialty)	-

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Peer evaluators	Direct: Peer evaluation
Effectiveness of student's assessment	Students	Indirect: Questionnaire Survey at the end of each semester.
Quality of learning resources	Program Leaders /Teaching staff/ Development and accreditation committee	Indirect: Review by Department Committee
The extent to which CLOs have been achieved	Program Leaders /Teaching staff/ Development and accreditation committee	Indirect: Review course reports and program annual reports by Department Committee
Other	-	-

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Department council
REFERENCE NO.	06
DATE	**21/01/2024**