هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications
(Postgraduate Degree)

Course Title:	**Bioinformatics in Biodiversity**
Course Code:	**BIOD 518**
Program:	**M. Sc. Biodiversity**
Department:	**Biology**
College:	**Science**
Institution:	**University of Tabuk**

Table of Contents

A. Course Identification

1. Credit hours: **3 Credit Hours (2 Theoretical + 1 Practical)**
2. Course type ☐ Required ☒ Elective
3. Level/year at which this course is offered: **Level 3/Second year**
4. Pre-requisites for this course (if any)**: BIOD 509**
5. Co-requisites for this course (if any)**:**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	4	100
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
1	**Lecture**	26
2	**Laboratory/Studio**	26
3	**Seminars**	
4	**Others** (specify)	
Total		52

B. Course Objectives and Learning Outcomes

1. Course Description

- This course helps the students to develop skills in the application of computational methods for the analysis of biological data. It provides theoretical and practical background on a computational analysis in Genomics and Proteomics; DNA sequencing and fragment assembly, identification of genes in DNA, gene regulation, expression, methods to study genetic diversity, homology and analogy, protein folding, and protein structure. It also provides skills in the search of DNA and protein sequences from different databases resources, homology and pattern-based search algorithms, and sequence and evolutionary search comparisons.

2. Course Main Objective

By the end of this course, the students should be able to:

- Know up-to-date information in molecular biology and bioinformatics.
- Understand and apply technologies to determine genome structure, sequences, and find out the structure of the protein.
- Study the structure of genes, genomes, mapping, and DNA sequencing algorithms
- Measure and analyze biological databases.
- Develop appropriate bioinformatics tools for the management and joining of the next-generation sequencing data to evaluate biodiversity.

3. Course Learning Outcomes

Course Learning Outcomes (CLOs)		Aligned PLOs*
1	**Knowledge and Understanding:**	
1.1	Outline basic molecular tools involved in DNA analysis (e.g. sequencing) which support bioinformatics-based analysis.	K4
1.2	Recognize the differences between databases, tools, and repositories.	K1
1.3	Describe a variety of currently available genomic, and proteomic databases.	K3
1.4	Describe the principles and applications of microarrays.	K3
1…		
2	**Skills:**	
2.1	Analyze biological sequences and interpret the analyzed results.	S3
2.2	Use appropriate tools at NCBI and EBI to run simple analyses on biological sequences.	S2
2.3	Apply elementary comparative genomic analysis.	S2
2.4	Predict molecular structures from genomic information including promoters, open reading frames (introns, exons), genes, and predicted protein structures.	S3
2…		
3	**Values:**	
3.1	Illustrate consensus sequences, genes, and open reading frames within biological sequences.	V1
3.2	Manipulate data from specific databases using accessions numbers, gene names, etc.	V2
3.3	Construct phylogenetic trees based on biological sequence data.	V1
3.4	Perform elementary predictions of protein structure and function.	V1
3…		

* Program Learning Outcomes

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to bioinformatics	2
2	DNA replication, transcription, and translation, Genome Organization, molecular biology methods	2
3	Introduction to DNA and protein databases, data storage, file formats, information retrieval	2
4	Collection and assessment of genome-related data	2
5	Database queries, sequence retrieval, Creation of restriction endonuclease maps, Database searching (e.g. FASTA and BLAST algorithms)	2
6	Dot plots, Sequence alignment, Local alignment, Global alignment, Multiple alignments	2
7	Sequence alignments continued, Alignment scores, Statistical significance of database searches	2
8	Genome analysis including gene prediction and identification	2
9	Protein classification, structure, and prediction	2
10	Phylogenetic relationships, Phylogenetic tree	2
11	Microarrays and the transcriptome analysis and applications	2

12	Analysis of protein structure, and function	2
13	Comparative genomics, Future perspectives of bioinformatics	2
Total		26

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 and Understanding:**		
1.1	Outline basic molecular tools involved in DNA analysis (e.g. sequencing) which support bioinformatics-based analysis.	- Lectures. - Group discussions. - Brainstorming. - The use of educational techniques (Videos). - Student's seminars. - Individual presentation. - Lab. demonstrations. - Field surveys.	- Oral discussions. - Long and short essays. - Exams (Mid and Final) - Homework. - Quizzes. - Demonstrations. - Lab. reports. - Field reports.
1.2	Recognize the differences between databases, tools, and repositories.		
1.3	Describe a variety of currently available genomic, and proteomic databases.		
1.4	Describe the principles and applications of microarrays.		
1….			
2.0	**Skills:**		
2.1	Analyze biological sequences and interpret the analyzed results.	- Lectures. - Group discussions. - Brainstorming. - Simulation. - Research paper-based learning. - The use of interactive video. - Lab. demonstrations. - Individual presentation. - Field surveys.	- Peer assessment. - Self-evaluation. - Oral discussion. - Exams (Mid and Final) - Quizzes. - Individual and group presentations. - Lab. reports. - Field reports.
2.2	Use appropriate tools at NCBI and EBI to run simple analyses on biological sequences.		
2.3	Apply elementary comparative genomic analysis.		
2.4	Predict molecular structures from genomic information including promoters, open reading frames (introns, exons), genes, and predicted protein structures.		
2….			
3.0	**Values:**		
3.1	Illustrate consensus sequences, genes, and open reading frames within biological sequences.	- Research activities. - Oral presentations. - An internet search, assignments, and essays. - Group discussion. - Case studies. - Individual, and group presentations.	- Student's essays and assignments. - Group reports. - Group presentations. - Discussion in lectures. - Student's written participation. - Analytical reports.
3.2	Manipulate data from specific databases using accessions numbers, gene names, etc.		
3.3	Construct phylogenetic trees based on biological sequence data.		
3.4	Perform elementary predictions of protein structure and function.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			- Lab. reports. - Case studies. - Posters.
3…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Activities and Short Quizzes	Distributed over 8 weeks	10
2	Pre-Final Practical Exam	8	10
3	Pre-Final Theoretical Exam	8	25
4	Final Practical Exam	15	15
5	Final Theory Exam	16	40
6			
7			
8			
9			
	Total		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:

- Eight office hours per week per faculty member.
- Academic advising sessions 1hr/ week per faculty member.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	- Lesk, A. (2019). Introduction to Bioinformatics. 5th edition, pp. 432. Oxford University Academic Press. ISBN: 9780198794141. - Muthuchelian, K. (2016). Bioinformatics, Barcoding and Benefit Sharing in Biodiversity, pp. 401. Educationist Press, a division of Write & Print Publication. ISBN: 9789384649388. - Zvelebil, M. and Baum, J. O. (2008). Understanding Bioinformatics, Garland Science. ISBN 0 81 534024 9. - Xiong, J. (2006). Essential Bioinformatics. Cambridge University Press. ISBN: 9780511806087. - Krane, D. E. and Raymer, M. L. (2011). Fundamental concepts of bioinformatics, 4th edition, Pearson India. ISBN-13: 978-8177587579. - Agostino, M. J. (2013), Practical Bioinformatics, pp. 367. Garland Science. ISBN: 9780815344568.
Essential Reference Materials	- *Fundamentals of Bioinformatics.* - *International Journal of Bioinformatics.*

Electronic Materials	- Saudi Digital Library. - UNSEDOC Digital Library. - www.sciencedirect.com
Other Learning Materials	- Multimedia that is associated with the textbook and the relevant websites.

2. Educational and Research Facilities and Equipment Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- A sufficient number of classrooms, well equipped practical laboratories are available to accommodate 30-40 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	- Data show projectors and wireless internet connection available for students and faculties. - Smart blackboard. - Computer Portable PowerPoint presentations.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	- Lecture slides. - Reference Book. - A Note Book for writing notes. - Well-equipped laboratory.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching and assessment.	- Students.	• Indirect - Questionnaires.
- Quality of learning resources.	- Program committee. - Staff members. - Students.	• Direct - Questionnaires. - Reports. - Meetings.
- The extent of achieving the course learning outcomes.	- Program leaders. - Peer Reviewer.	• Direct & Indirect - Questionnaires. - Reports. - Meetings.

Evaluation Areas/Issues (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

Council / Committee	Biology Department Members who constructed the program
Reference No.	Committee members – The academic year 1441/1442
Date	