Teaching guide

IDENTIFICATION DETAILS

Degree:	Biotechnology
Scope	Biology and Genetics
Faculty/School:	Experimental Sciences
Course:	BIOINFORMATICS
Type:	Compulsory
ECTS credits:	6
Year:	3
Code:	2031
Teaching period:	Fifth semester
Subject:	Advanced Biotechnology Training Technologies
Module:	Biotechnology Tools
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	150

SUBJECT DESCRIPTION

Description of the fundamentals of bioinformatics (both computationally and biologically) and familiarization with the most common applications and services.

Description of the fundamentals of bioinformatics (both computationally and biologically) and familiarization with the most common applications and services. Advances in molecular biology and other areas have generated an exponential growth of information from experimental sources. Through bioinformatics, advances in information and communication technologies have made it possible to address this phenomenon by offering new data management and processing systems, as well as analysis tools that make possible approaches inaccessible by other means. This course aims to introduce students to bioinformatics both at a practical level, showing the use of tools and services (database search and retrieval, sequence comparison, alignment, construction of phylogenetic

trees, etc.), and at a theoretical level, explaining basic programming fundamentals and the ideas on which the tools they are going to use are based.

GOAL

The final objective of the Bioinformatics course is to acquire fundamental skills to understand, manage and interpret bioinformatic resources and predictive models derived from them on the function of genes, proteins and other biomolecules.

The specific aims of the subject are:

Efficiently manage the PubMed bibliographic search engine and use it as a scientific tool.

Search for and download sequences from biological databases and understand the differences between different types of sequences and databases.

Align different types of sequences and understand their meaning and usefulness.

Make phylogenetic trees from multiple sequence alignments.

Download and visualize three-dimensional structures of biomolecules and extract specific information from them.

Acquire basic programming knowledge in Python 3.

PRIOR KNOWLEDGE

It is not recommended to take the subject until the subjects have been approved:
- Basic genetics.
- Foundations of biochemistry. Even if these subjects have been approved, it is recommended to review their contents before the start of the course. Additionally, in order to be able to follow the subject fluently, the following skills are needed:
- A fluent understanding of written technical/scientific English. The literature and tools that will be used for the most part are only available in English.
- Basic computer skills (the operating system doesn't matter). Browse the Internet efficiently, understand directory structures, know how to install and uninstall programs, etc.

COURSE SYLLABUS

Block 1. Introduction to Scientific Computing.
Topic 1. Introduction to Bioinformatics
Theme 2. Scientific publications and bibliography. NCBI database
Block 2. Sequence analysis.
Theme 3. Search for homologous nucleotide sequences and sequence comparison
Topic 4. Search for homologous amino acid sequences and sequence comparison

Topic 5. Multiple sequence alignments
Theme 6. Construction of phylogenetic trees
Block 3. Structural bioinformatics.
Topic 7. Search and visualization of protein structures in 3D.
Block 4. Introduction to programming

EDUCATION ACTIVITIES

The teaching + learning methodology in the Bioinformatics subject will be carried out through the following mandatory training activities (AF):
AF1. Participatory expository class sessions.
AF2. Participatory theoretical-practical class sessions.
AF3. Carrying out work/practical project.
AF4. Tutoring.

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
60 Horas	90 Horas

SKILLS

Basic Skills

Students must have demonstrated knowledge and understanding in an area of study that is founded on general secondary education. Moreover, the area of study is typically at a level that includes certain aspects implying knowledge at the forefront of its field of study, albeit supported by advanced textbooks

Students must be able to apply their knowledge to their work or vocation in a professional manner and possess skills that can typically be demonstrated by coming up with and sustaining arguments and solving problems within their field of study.

Students must have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that include reflections on pertinent social, scientific or ethical issues

Students must be able to convey information, ideas, problems and solutions to both an expert and non-expert audience

Students must have developed the learning skills needed to undertake further study with a high degree of independence

To acquire firm theoretical, practical, technological and humanistic training needed to develop professional activity.

Capacity for teamwork and group management.

To have acquired the ability for analytical, synthetic, reflective, critical, theoretical and practical thought.

Capacity for problem-solving and decision-making.

To be able to plan time effectively.

To foster a concern for knowledge as a key tool in the personal and professional growth process of a student.

To develop an ability to search for, take in, analyze, sum up and relate information.

To be familiar with the basic principles and theories of human and experimental sciences.

To develop oral and written communication skills.

To understand the fundamental laws and principles of physics, mathematics, chemistry and biology as the foundation for the mental structure of a biotechnician.

To acquire the skills needed for experimental work: design, preparation, the compilation of results and the obtainment of conclusions, understanding the limitations of an experimental approach.

General Skills

To acquire firm theoretical, practical, technological and humanistic training needed to develop professional activity.

Capacity for teamwork and group management.

To have acquired the ability for analytical, synthetic, reflective, critical, theoretical and practical thought.

Capacity for problem-solving and decision-making.

To be able to plan time effectively.

To foster a concern for knowledge as a key tool in the personal and professional growth process of a student.

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To acquire the skills needed for experimental work: design, preparation, the compilation of results and the obtainment of conclusions, understanding the limitations of an experimental approach.

Specific skills

Know and understand the applicability of multidisciplinary techniques that include concepts of protein chemistry, mass spectrometry, protein treatment and manipulation, biostatistics and bioinformatics.

Apply bioinformatics to obtain information regarding the comparison of sequences and structures, functional clustering, phylogenies, etc. of biomolecules.

Know and know how to apply new genomic techniques to the fields of medicine, biology, pharmacy and agriculture.

Develop habits of rigorous thinking

Know how to apply the theoretical knowledge acquired to solving problems and practical cases related to different subjects.

Know how to work as a team in an effective and coordinated way.

Be able to self-evaluate the knowledge acquired.

LEARNING RESULTS

Search scientific literature efficiently.

It manages the main biological information databases accessible through the Internet.

Manages bioinformatics tools based on the search for homologous sequences and sequence alignment.

Perform multiple alignments of sequences and simple phylogenetic trees.

Obtains and visualizes relevant three-dimensional protein structures for subsequent analysis.

Interpret simple scripts in Python 3.

Writing correctly, using appropriate language and scientific rigor

LEARNING APPRAISAL SYSTEM

The evaluation of the subject seeks to assess the acquisition and degree of development of all the competencies provided for in this teaching guide by students. MINIMUM REQUIREMENTS TO PASS THE SUBJECT In any call and evaluation system, the subject is passed by obtaining a minimum score of 5 in each and every one of the 'CAL' grades broken down into the following sections of this Teaching Guide.
EVALUATION SYSTEMS

1) ORDINARY: Based on continuous evaluation. The final grade will consist of the following grades, according to the indicated percentages:
-CAL1 (50%): Evaluation of the theoretical, practical and methodological contents covered in the course. It will consist of test-type, short-answer and/or development questions. The evaluation may be carried out throughout the semester and/or through a written or oral final exam.
-CAL2 (10%): Exercises or tasks (individual or group) from applied theoretical-practical classes. It will include the evaluation of exercises and tasks proposed in class. The student's degree of learning about the exercises and tasks presented will be evaluated individually or in groups.
-CAL3 (25%): Evaluation of a Final Subject Work (TFA) or other activities developed during the course. The student's degree of learning about the papers presented will be evaluated through written work, scheduled tutoring and/or an independent oral exam of CAL1.
-CAL4 (15%): Evaluation of the programming part. This will be carried out through a written exam at the end of the semester and will measure with the final grade of the subject, although it will not be mandatory to pass it to pass the course.
Extraordinary calls: In the event of not having passed CAL1, a single written exam must be carried out on the same contents evaluated in the continuous evaluation. In the event of not passing CAL2 and/or CAL3, the student must submit the exercises, papers and suspended activities carried out during the semester of the current academic year (including seminars). As a general rule, the qualifications of the different parties approved in the ordinary call will be preserved.
2) ALTERNATIVE (option only for repeat students). Not based on continuous evaluation. The teaching-learning process will be monitored through tutoring, which may be mandatory. 'This system is intended for repeat students who do not take advantage of the ordinary evaluation system because they cannot attend classes on a regular basis'. Students with a second or subsequent enrollment must contact the teacher at the beginning of the course (first 2 weeks) to apply for this system. The final grade will consist of the following grades, according to the indicated percentages:
-CAL1 (60%): Exam on the theoretical, practical and methodological contents covered in the subject. It will consist of test-type, short-answer and/or development questions. This section includes programming content.
-CAL2 (30%): Evaluation of a Final Subject Work (TFA) or other activities developed during the course. The student's degree of learning about the papers presented will be evaluated through written work, scheduled tutoring and/or an independent oral exam of CAL1.
-CAL3 (10%): Tutoring and solving applied individual or group exercises. It will include the evaluation of the exercises, preparation of reports and the evaluation of the tutorials. The student's degree of learning about the papers presented may be evaluated by means of a written or oral exam independent of CAL1.
Extraordinary calls. In the event of not having passed CAL1, a single written exam must be carried out on the same contents evaluated in the ordinary call. In the event of not passing CAL2, the student must submit the final work or the suspended activities carried out during the semester of the current academic year (including seminars). As a general rule, the qualifications of the different parties approved in the ordinary call will be preserved.
EXAMS AND PARTIAL TESTS There is the possibility of proposing partial tests. The criteria for including these grades in the final grade of the subject will be communicated in class well in advance to all enrolled students and through publication in the virtual classroom system of the subject.
SECOND AND SUBSEQUENT ENROLLMENT: (repeat students) Repeat students who are unable to attend classes on a regular basis, have the option of taking advantage of the Alternative Assessment System. To request to be evaluated using this system, they must necessarily contact the teacher at the beginning of the course. If this is not done, it is assumed that the student accepts the Ordinary Assessment System. (See 'Alternative Assessment System'). As a general rule, CAL1, CAL2 and CAL3 scores are not retained between academic years.
DEADLINES FOR SUBMITTING PAPERS: The time allotted for the completion and delivery of papers or tasks will be announced in the virtual classroom well in advance. Papers submitted after the deadline will be rated zero.
GENERAL CRITERIA FOR EVALUATING ACTIVITIES: Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with those established in the Evaluation Regulations and the

University's Coexistence Regulations.
When grading exams and papers, the technical and scientific correctness of the student's original production, as well as their expressive capacity and language correction, will be assessed. For this purpose, account will be taken of (1) the ownership of vocabulary and syntax, (2) the formal correction of schemes, tables and references, and (3) the appropriate general presentation. In the particular case of written works, the mere presentation of results copied from calculation programs or bioinformatics resources/services for public use on the Internet does not imply obtaining an approval. To approve these works, it will be essential for the student to contribute in an original way to the production subject to evaluation.

ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE

1.- The use of any Artificial Intelligence (AI) system or service shall be determined by the lecturer, and may only be used in the manner and under the conditions indicated by them. In all cases, its use must comply with the following principles:
a) The use of AI systems or services must be accompanied by critical reflection on the part of the student regarding their impact and/or limitations in the development of the assigned task or project.
b) The selection of AI systems or services must be justified, explaining their advantages over other tools or methods of obtaining information. The chosen model and the version of AI used must be described in as much detail as possible.
c) The student must appropriately cite the use of AI systems or services, specifying the parts of the work where they were used and describing the creative process followed. The use of citation formats and usage examples may be consulted on the Library website(https://www.ufv.es/gestion-de-la-informacion_biblioteca/).
d) The results obtained through AI systems or services must always be verified. As the author, the student is responsible for their work and for the legitimacy of the sources used.
2.- In all cases, the use of AI systems or services must always respect the principles of responsible and ethical use upheld by the university, as outlined in the Guide for the Responsible Use of Artificial Intelligence in Studies at UFV. Additionally, the lecturer may request other types of individual commitments from the student when deemed necessary.
3.- Without prejudice to the above, in cases of doubt regarding the ethical and responsible use of any AI system or service, the lecturer may require an oral presentation of any assignment or partial submission. This oral evaluation shall take precedence over any other form of assessment outlined in the Teaching Guide. In this oral defense, the student must demonstrate knowledge of the subject, justify their decisions, and explain the development of their work.

BIBLIOGRAPHY AND OTHER RESOURCES

Basic

David W. Mount. Bioinformatics: sequence and genome analysis 2nd ed. New York: Cold Spring Harbor, 2004. (David W. Mount. Bioinformatics: sequence and genome analysis 2nd ed. New York: Cold Spring Harbor, 2004. , ||Lesk, Arthur M. Introduction to Bioinformatics 4th ed. Oxford: Oxford University Press, 2014)