Course guide
390339 - BMEBT - Molecular Biology and Biotechnology Tools

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 745 - DEAB - Department of Agri-Food Engineering and Biotechnology.

Degree: BACHELOR’S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2022 ECTS Credits: 6.0 Languages: Catalan, Spanish, English

LECTURER

Coordinating lecturer: Roig Villanova, Irma
Others: Roig Villanova, Irma

REQUIREMENTS

It is highly recommended to have taken and passed the first year General Biology course or equivalent.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

TEACHING METHODOLOGY

The directed learning hours consist of theoretical classes (large group) in which the teacher makes a presentation to introduce the general learning objectives related to the basic concepts of the subject, trying to motivate and involve the students to actively participate in their learning. Support material is used through ATENEA.

Practical sessions in small groups so that the students practice some of the techniques related to molecular biology and genetic engineering. Before carrying out the practice, the students must read the protocol and support material that the teacher has prepared in order to know the objectives of the practice. Usually, after each session tasks are proposed outside the classroom, which must be done either individually or in groups and which are the basis of the directed activities.

Extra hours of autonomous learning must also be considered, such as those devoted to protocol reading, solving the proposed problems or self-learning tests for the different contents through the virtual campus ATENEA or on paper.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course Molecular Biology and Biotechnological Tools, the student must be able to:
- Understand the molecular bases and mechanisms of gene transmission and expression.
- Know the biotechnological tools and the methodologies applied to genetics, genomics, transcriptomics and proteomics.
- Know the development and application of tools for the management and analysis of biological data.
- Know and correctly apply the information obtained in the different databases specific of the subject.
- Understand and correctly relate the different specific computer applications for the management and processing of biotechnological data (Bioinformatics).
**STUDY LOAD**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>20,0</td>
<td>13.33</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>40,0</td>
<td>26.67</td>
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</tbody>
</table>

**Total learning time:** 150 h

**CONTENTS**

**MOLECULAR GENETICS**

**Description:**
In this content we work:
- Basic concepts of molecular genetics
- Definition of genomics, proteomics, metabolomics and transcriptomics
- Genetic engineering within molecular biology

**Related activities:**
- Activity 1: Theoretical classes
- Activity 2: Individual assessment tests

**Full-or-part-time:** 4h
- Theory classes: 2h
- Self study: 2h

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**MUTAGÈNESIS I METODOLOGIA BÀSICA DE L'ENGINYERIA MOLECULAR**

**Description:**
In this content we work:
- Mutant types and detection
- Degradation and synthesis of nucleic acids in vitro
- Restriction enzymes and their applications
- DNA sequencing
- Polymerase chain reaction

**Related activities:**
- Activity 1: Theoretical classes
- Activity 2: Individual assessment tests
- Activity 3: Laboratory activities

**Full-or-part-time:** 35h
- Theory classes: 11h
- Laboratory classes: 4h
- Self study: 20h
### SEQUENCES AMPLIFICATION AND OBTENTION OF RECOMBINANT DNA

**Description:**
In this content we work:
- Cloning techniques
- Genomic libraries
- Cloning vectors
- Expression of recombinant DNA

**Related activities:**
- Activity 1: Theoretical classes
- Activity 2: Individual assessment tests
- Activity 3: Laboratory activities

**Full-or-part-time:** 33h
- Theory classes: 7h
- Laboratory classes: 6h
- Self study: 20h

### GENE TRANSFERENCE TO DIFFERENT TYPES OF ORGANISMS

**Description:**
In this content we work:
- Gene transfer to yeast and insects
- Gene transfer to plants
- Gene transfer to cells or whole mammalian organisms

**Related activities:**
- Activity 1: Theoretical classes
- Activity 2: Individual assessment tests
- Activity 3: Laboratory activities

**Full-or-part-time:** 53h
- Theory classes: 15h
- Laboratory classes: 6h
- Self study: 32h

### (ENG) BIOINFORMÀTICA

**Description:**
Relationship between Biology and bioinformatics
- Software tools
- Sequence Analysis
- Comparative and functional genomics

**Related activities:**
- Activity 1: Theoretical classes
- Activity 2: Individual assessment tests
- Activity 3: Laboratory activities
- Activity 4: Activities with computers

**Full-or-part-time:** 25h
- Theory classes: 5h
- Laboratory classes: 4h
- Self study: 16h
**ACTIVITIES**

**ACTIVITY 1: THEORETICAL CLASSES**

**Material:**
Class presentations (power point files), support material in ATENEA and basic bibliography of the subject.

**Full-or-part-time:** 103h
- Theory classes: 38h
- Self study: 65h

**ACTIVITY 2: INDIVIDUAL EVALUATION TESTS**

**Description:**
Short questions and topics to be developed related to the theoretical content of the classes, the laboratory and the computer sessions.

**Specific objectives:**
Evaluation of the capacity of autonomous learning of the student.

**Material:**
Tables and calculator

**Delivery:**
Resolution of the test by the student. Registration by the teacher of the verification of the autonomous and directed learning of the student. The results are considered for the proposed global evaluation.

**Full-or-part-time:** 2h
- Theory classes: 2h

**ACTIVITY 3: LABORATORY PRACTICES**

**Description:**
2-hour lab practice. Attendance to laboratory practices is mandatory.

**Specific objectives:**
At the end of the practices, the student must be able to:
- Work in the laboratory following environmental and safety guidelines.
- Assess the importance of the organization of laboratory work.
- Correctly carry out the operations of handling laboratory material and biological samples.
- Correctly use laboratory instruments.
- Evaluate own results and reference them to the results of colleagues.

**Material:**
Material and reagents necessary to carry out the practices.
Detailed protocol/script of the practices to be carried out and questionnaire.

**Delivery:**
Registration by the teacher of the verification of the student’s directed learning. The results are considered for the qualification of the laboratory activities.

**Full-or-part-time:** 23h
- Laboratory classes: 10h
- Self study: 13h
ACTIVITY 4: BIOINFORMATICS PRACTICES

Description:
Practices in a computer room (or with students personal laptops) of 2 hours of duration

Specific objectives:
At the end of the practices the student must be able to:
Assess the potential and / or limitations of the models that can be used to simulate different biological processes.
Obtain adequate and updated information from the different biotechnological databases.
Use programs to solve specific sequence analysis problems.
Evaluate own results and reference them to the results of colleagues.

Material:
Internet access, access to Atenea, practice protocol and individual computer

Delivery:
Registration by the teacher of the verification of the student's directed learning.
The results are considered for the qualification of the activities.

Full-or-part-time: 22h
Laboratory classes: 10h
Self study: 12h

GRADING SYSTEM
The final grade is the weighted sum of the following partial grades:
N1: Score of the test of the first part of the subject (the test is the partial exams and in the finals as a second chance)
N2: Score of the test of the second part of the subject (the test is done in the final exams)
N3: Score of the tests of lab activities.
N4: Score of scientific reading.
Final grade = 0.3N1 + 0.3N2 + 0.2N3 + 0.2N4

EXAMINATION RULES.
For the practical sessions in the laboratory it is necessary to bring the protocol/script of practices and to respect the rules of safety and hygiene.
Attendance at laboratory practices is mandatory. The no assistance could result in the non-evaluation of these activities.

BIBLIOGRAPHY
Basic: