SHORT DESCRIPTION AND JUSTIFICATION (of the meaning of the course in relation to the studies. Between 100 and 200 words)

The aim of this course is to provide students with the basic knowledge of recombinant DNA technology and genetic engineering disciplines, and requires previous knowledge of molecular biology of the cell acquired in the course Molecular Biology of the third semester of degree in biotechnology.

The course covers the basic techniques to study gene function and manipulation, and how this knowledge is used innovatively in biotechnology. Understanding the basic principles of recombinant DNA technology and these principles are applied for the genetic manipulation of biological systems is central to modern molecular biotechnology. The course is divided into chapters that cover the main aspects of genetic engineering and molecular biotechnology, such as manipulation of DNA, cloning vectors, construction and use of genomic and cDNA libraries, cloning strategies in bacteria, yeast and higher eukaryotes, or mutagenesis.

COMPETENCES (of the course placed in relation to the pre-assigned competences in the subject matter)

- That students know how to apply their knowledge to their work or vocation in a professional manner, and have acquired the competencies that allow them to elaborate and defence arguments as well as to solve problems within their area of study (CB2).
- Be able to understand and apply advanced knowledge of Biosciences and Engineering to the field of Biotechnology (E3).
- Be able to use tools, systems or processes to carry out the activities in the field of Biotechnology according to the established requirements (E4).
PREVIOUS REQUIREMENTS * (modules, subject matters, courses or knowledge necessary for the follow-up of the subject. State previous courses required to be completed)

Students must have acquired knowledge of the basic module of the Degree in Biotechnology, related to the subjects Cell Biology and Genetics, Animal and Plant Biology and Microbiology. In addition, students must have completed Molecular Biology subject of the third semester of the Degree in Biotechnology.

CONTENTS (List the content of the course, with up to two level detail)

PART I. INTRODUCTION TO RECOMBINANT DNA TECHNOLOGY AND GENETIC ENGINEERING.
1. Historical perspective and biotechnological relevance.
2. Basic concepts.

PART II. BASIC TOOLS FOR CLONING.
3. Basic techniques of extraction and analysis of nucleic acids.
4. Enzymatic manipulation of nucleic acids.
5. DNA synthesis in vitro: The polymerase chain reaction (PCR).
7. Detection of nucleic acids.

PART III. GENE MANIPULATION IN CELLS AND ORGANISMS.
11. Cloning and expression systems in plants
12. Cloning and expression systems in animals.

PART IV. GENERATION, SELECTION AND ANALYSIS OF RECOMBINANTS.
13. Construction of cDNA and genomic libraries.
15. Sequencing and analysis of nucleic acids.

PART V. ROLE OF CLONED GENES.
17. Study of the regulation of gene expression.
18. Study of the function of the protein encoded by the gene.

* These features should not be modified without the approval of the academic board (subject matter, module and / or studies program).
LEARNING ACTIVITIES * (Complete the table relating activities, workload in ECTS credits, and competences.)

<table>
<thead>
<tr>
<th>Learning Activities</th>
<th>ECTS Credits</th>
<th>Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>1.8</td>
<td>E3, E4</td>
</tr>
<tr>
<td>Case and Problem-Solving Sessions</td>
<td>0.2</td>
<td>CB2, E3, E4</td>
</tr>
<tr>
<td>Seminars</td>
<td>0.1</td>
<td>CB2, E3, E4</td>
</tr>
<tr>
<td>Practical and Lab Work</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Presentations</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Personal Study</td>
<td>3.8</td>
<td>CB2, E3, E4</td>
</tr>
<tr>
<td>Assessment Tasks (Exams, Continuous Assessment...)</td>
<td>0.1</td>
<td>CB2, E3, E4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>6.0</td>
<td>CB2, E3, E4</td>
</tr>
</tbody>
</table>

TEACHING METHODOLOGY (justify the teaching methodology in relation to the competences and course contents. Between 100 and 200 words)

Attendance to classes is mandatory. Lectures include the presentation and explanation of contents by a teacher, and is combined with other class activities:

- **Case and Problem-Solving Sessions**: Resolution of exercises and problems, and exposition / discussion of cases by a teacher with the active participation of students. Collections of problems and quizzes are provided and solved by the students individually or in teams.

- **Seminars**: Period of instruction carried out by a teacher with the aim of reviewing, discussing and resolving doubts about the materials and topics presented in the lectures and in the case and problem-solving sessions.

The IQS virtual campus is used to provide students with teaching materials (presentations, articles and quizzes) and to maintain ongoing communication. Continuous assessment activities include conducting tests, quizzes and exercises. In addition, students develop a project that involves designing an experiment of cloning of a gene for a biotechnological purpose (in silico cloning project).

Personal study activities by the student serve to (i) prepare other activities; (ii) acquire the competences of each subject matter; and (iii) assimilate the knowledge exposed in lectures and case and problem-solving sessions, using the recommended reference materials.

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**ASSESSMENT**

**ASSESSMENT METHODS** * (Complete the table relating assessment methods, competences, and weight percentage in the course qualification)

<table>
<thead>
<tr>
<th>Assessment methods</th>
<th>Weight</th>
<th>Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Exam</td>
<td>40%</td>
<td>CB2, E3, E4</td>
</tr>
<tr>
<td>Midterm Exam/s</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Continuous Assessment Activities</td>
<td>35%</td>
<td>CB2, E3, E4</td>
</tr>
<tr>
<td>Reports and Presentations</td>
<td>20%</td>
<td>CB2, E3, E4</td>
</tr>
<tr>
<td>Lab or Field Work</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Projects</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Host Student Evaluation</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>5%</td>
<td>CB2, E3, E4</td>
</tr>
</tbody>
</table>

**LEARNING OUTCOMES** (Explanation of the student's achievements that allow the assessment of competences, relating them to the competences and the assessment methods)

- The student should be able to apply their knowledge of recombinant DNA technology and genetic engineering in a professional manner, through the preparation and defence of arguments and the solving problem capacity related to the subject area (CB2).

- The student must demonstrate knowledge of the basic techniques of genetic manipulation and the main cloning vectors, and to understand the fundamentals of gene cloning in yeast and higher eukaryotes. The student must understand and apply this advanced knowledge in Bioscience and Engineering to the field of Biotechnology (E3).

- The student must demonstrate the ability to solve problems through the design of basic experiments involving recombinant DNA technology and genetic engineering. The student must be able to use these tools, systems or processes to carry out the activities in the field of Biotechnology according to the established requirements (E4).

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QUALIFICATION (Explanation of the qualification system)

The qualification of the course (final grade, CF) will consider the marks obtained in the final exam (EF), the continuous assessment (AS), reports and presentations (TP), and participation (P). Each of these grades will be over 10 and have a maximum value of 10.

The final exam (EF) evaluates the synthesis of the subject. The qualification of the continuous assessment activities (AS) is calculated as a weighted average of the various activities. The qualification of the reports and presentations (TP) is calculated as a weighted average of the various activities. The participation grade (P) is assigned at the end of the course after assessing the level of student participation in global activities.

In order to pass the course, the grade of the final exam (EF) should be equal to or greater than 4.5. If less than 4.5, then this mark will be the final grade (CF) of the course.

If the grade of the EF is equal to or greater than 4.5, then the final grade (CF) of the course is calculated as a weighted average of the marks obtained in the final exam (EF, 40%), the continuous assessment activities (AS, 35%), the reports and presentations (TP, 20%), and participation (P, 5%):

\[
CF = 0.4 \times EF + 0.35 \times AS + 0.2 \times TP + 0.05 \times P
\]

The course is passed when this final grade (CF) is equal to or greater than 5.

ASSESSMENT OF THE COMPETENCES (Describe the grading system for each competence in relation with the assessment tasks)

For the evaluation of the competence CB2, the grade of the final exam (EF), the continuous assessment activities (AS), the reports and presentations (TP), and the participation (P) will be used as an indicator.

For evaluation of the E3 and E4 competences it will be used as indicator the grades of the EF, the AS, and the TP.

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COURSE: RECOMBINANT DNA TECHNOLOGY

SUBJECT MATTER: Molecular Biology
MODULE: Molecular and Cell Biology
PROGRAM: Degree in Biotechnology

BIBLIOGRAPHY (Recommended and accessible to the student.)

( Http://www.currentprotocols.com/WileyCDA/)

DOCUMENT HISTORY

PREVIOUS REVISIONS (Indicate date and author / s, first the most recent one)

CURRENT REVISION (Indicate date and author / s)
Mars 22nd 2019, Dr. Pablo Leivar

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