COURSE: TISSUE ENGINEERING

SUBJECT MATTER: Biotechnology for Health

MODULE: Optional Subjects

PROGRAM: Degree in Biotechnology

GENERAL FEATURES *

Type: ☐ Basic formation, ☑ Compulsory, ☐ Elective
☐ Final Degree Project, ☐ Practicum

Duration: Semestral
Semester / s: 7

Number of ECTS credits: 5

Language / s: English

DESCRIPTION

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

The student will learn the main concepts of tissue engineering and 3-dimensional cultures to obtain organ replicas and substitutes for diagnostic, research and therapy. The main aspects of regeneration potential of tissues or scar development will be given in the context of tissue stem cell recruitment or mature tissue cell activation and response to injury. Cell mechanics and concepts of forces and flows will be learned in the context of parameters to be considered to build better tissues in the laboratory in addition with biological and chemical signals.

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

- That students develop those learning skills necessary to undertake further studies with a high degree of autonomy (CB5).
- Be able to assess the impact of their professional activity on the sustainable development of society (T3).
- Be able to incorporate contemporary aspects related to the exercise of their profession (T5).
- Be able to understand and apply advanced knowledge of Biosciences and Engineering to the field of Biotechnology (E3).
- Be able to integrate the knowledge and tools of biotechnology for their application to different industrial sectors that use, develop or produce biotechnological products or processes (E6).

PREVIOUS REQUIREMENTS * (modules, subject matters, courses or knowledge necessary for the follow-up of the subject. State previous courses required to be completed)

Molecular Biology, Molecular Physiology, Cell Culture, Biomaterials, Laboratory of Health Biotechnology

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

Table of contents (by chapters)

1. Multicellular organisms: the social life of cells
   1.1. Cell-cell interactions and their molecular bridges (glue molecules)
   1.2. Gap-junctions (molecular trafficking between cells)
   1.3. Extracellular matrix (a plastic microenvironment)
   1.4. Continuum Mechanics (concept, examples)
   1.5. Papers to read and exposure

2. Biomaterials, bioengineering and cells: the integrative concept
   2.1. Ideal biomaterial platforms for tissue engineering
   2.2. Bioengineering: biomechanics and biophysics helps!
   2.3. The integrative concept: all together of nothing
   2.4. Papers to read and exposure

3. Basic principles of tissue engineering
   3.1. Engineering bone and cartilage tissue
   3.2. Engineering liver tissue
   3.3. Engineering cardiac tissue
   3.4. Papers to read and exposure

4. Development of 3D cancer models
   4.1. Cancer cells and cancer microenvironment
   4.2. Epidermal to mesenchymal transition (EMT)
   4.3. Cancer cells have indefinite cell growth, why?
   4.4. Drug resistance: a bottleneck in pharmaceutical drug discovery

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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>1,3</td>
<td>CB5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Case and Problem-Solving Sessions</td>
<td>0,1</td>
<td>CB5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Seminars</td>
<td>0,1</td>
<td>CB5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Practical and Lab Work</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Presentations</td>
<td>0,1</td>
<td>CB5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Personal Study</td>
<td>3,3</td>
<td>CB5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Assessment Tasks (Exams, Continuous Assessment...)</td>
<td>0,1</td>
<td>CB5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5,0</td>
<td>CB5, T3, T5, E3, E6</td>
</tr>
</tbody>
</table>

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

- **Lectures** - Presentation and explanation of contents by a teacher (possibly including demonstrations).
- **Case and Problem-Solving Sessions** - Resolution of exercises and problems, and exposition / discussion of cases by a teacher with the active participation of students.
- **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.
- **Presentations** - Oral presentation by a student to a teacher and/or other students. The presentation can be a work prepared by the student through searches in published bibliography, or a summary of a practical work or a project.
- **Personal study activities** - Personal work of the student necessary to acquire the competences of each subject matter, and to assimilate the knowledge exposed in lectures and case and problem-solving sessions, using the recommended reference materials. They also include the preparation of tasks related to the other activities, and the preparation of exams.
- **Assessment Tasks** - Oral and / or written tests made during the academic period of a course, or once it has finished (final exams, follow-up controls).

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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>CB5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Midterm Exam/s</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Continuous Assessment Activities</td>
<td>35%</td>
<td>CB5, E3, E6</td>
</tr>
<tr>
<td>Reports and Presentations</td>
<td>20%</td>
<td>CB5, E3, E6</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>CB5, E3, E6</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 understand and apply advanced knowledge of Biosciences and Engineering to the TISSUE ENGINEERING. (E3, E6)

The student should be able to use tools, systems or processes to carry out the activities in the field of TISSUE ENGINEERING according to the established requirements. (CB5, T3, T5, E3, E6)

QUALIFICATION (Explanation of the qualification system)

The FINAL EXAM and the AVERAGE OF THE CONTINUOUS ASSESSMENT ACTIVITIES and REPORTS AND PRESENTATIONS should be equal or higher than 4 (MAXIMUM QUALIFICATION FOR EACH IS = 10).

FINAL QUALIFICATION: FINAL EXAM (40%) + Control Exams (35%) + Reports and Presentations (20%) + Participation (5%) = 100%

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

For evaluation of competences T3 and T5 the grade of the final exam will be used as indicator.

For evaluation of competences CB5, E3 and E6, it will be used as indicator the grade of the final exam, the continuous assessment activities, the reports and presentations, and the participation.

**BIBLIOGRAPHY** (Recommended and accessible to the student.)

- Developmental Biology, Gilbert.
- Coming to Life; How Genes Drive Development, Christiane Nuslein-Volhard.

**DOCUMENT HISTORY**

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

**CURRENT REVISION** (Indicate date and author / s)
13 of May, 2019. Dr. Carlos Semino Margrett

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