240EQ221 - Protein Engineering

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2017
Degree: MASTER'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Optional) MASTER'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 6

Teaching staff
Coordinator: Juan Jesus Perez Gonzalez
Others: Luis del Valle Mendoza
Pere Garriga Solé

Opening hours
Timetable: consult each Professor

Prior skills
Basic knowledge in biochemistry

Degree competences to which the subject contributes

Specific:
1. Apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience, and practice, critical reasoning to establish economically viable solutions to technical problems.

General:
2. Possess independent learning skills to maintain and enhance the competencies of chemical engineering to enable the continued development of their profession.

Transversal:
3. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.
4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

Teaching methodology
Learning Contract. Lectures

Learning objectives of the subject
The aim of the subject is to provide knowledge on the biosynthesis, structure and function of proteins. Furthermore, the techniques associated with gene cloning and expression of recombinant proteins. Provide knowledge of the protein design with specific properties.
<table>
<thead>
<tr>
<th>Study load</th>
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<tbody>
<tr>
<td><strong>Total learning time:</strong> 150h</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Hours large group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Hours medium group:</td>
<td>54h</td>
<td>36.00%</td>
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<tr>
<td>Hours small group:</td>
<td>96h</td>
<td>64.00%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>96h</td>
<td>64.00%</td>
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</table>
## Content

<table>
<thead>
<tr>
<th>1. SYNTHESIS OF PROTEINS</th>
<th>Learning time: 50h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 16h</td>
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<tr>
<td></td>
<td>Practical classes: 10h</td>
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<tr>
<td></td>
<td>Guided activities: 4h</td>
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<tr>
<td></td>
<td>Self study: 20h</td>
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</tbody>
</table>

**Description:**
Knowledge about the translation and expression of proteins

**Related activities:**
Use of biocomputing tools

**Specific objectives:**
- Structure of the genes: operationals and structural. Transcription and genetic code.
- Structure and function of the RNA: mRNA, tRNA, rRNA and lRNA. The ribosome.

<table>
<thead>
<tr>
<th>2. STRUCTURE AND FUNCTION OF PROTEINS</th>
<th>Learning time: 20h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Guided activities: 2h</td>
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<td>Self study: 12h</td>
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</tbody>
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**Description:**
Provide knowledge about the structure of proteins

**Related activities:**
Use of the database pdb

**Specific objectives:**
- Secondary, tertiary and quaternary structure. Function of the proteins.
- Structural flexibility of the proteins. Protein fold.

<table>
<thead>
<tr>
<th>3. EXPRESSION OF RECOMBINANT PROTEINS</th>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Laboratory classes: 4h</td>
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<tr>
<td></td>
<td>Guided activities: 5h</td>
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<tr>
<td></td>
<td>Self study: 10h</td>
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</tbody>
</table>

**Description:**
Provide knowledge about the expression of recombinant proteins

**Related activities:**
Expression and purification of recombinant proteins

**Specific objectives:**
- Expression of proteins in cellular culture, purification and characterisation of recombinant proteins
## 4. DIRECTED MUTAGENESIS

### Description:
Provide knowledge about the directed mutagenesis

### Related activities:
Expression and purification of recombinant proteins

### Specific objectives:
Directed mutagenesis. Functional tests and spectroscopies of analysis of the recombinant proteins.

### Learning time:
- Theory classes: 6h
- Practical classes: 9h
- Self study: 10h

## 5. ENZYMES

### Description:
Description of the function of enzymes

### Specific objectives:
Protein-ligand interactions. Enzyme mechanisms

### Learning time:
- Theory classes: 4h
- Practical classes: 4h
- Self study: 12h

## 6. DESIGN OF PROTEINS WITH SPECIFIC FUNCTIONS

### Description:
Analyze real cases of the novo design

### Related activities:
Bibliographic research of examples using the directed mutagenesis for the protein design with new functions.

### Specific objectives:
Description of examples about modification and design of novo of proteins

### Learning time:
- Theory classes: 4h
- Self study: 6h

## Qualification system

Written exam (60%), Questions, test, problems, small-reports (40%)

## Bibliography