### Degree competences to which the subject contributes

**Specific:**

1. Ability to analyze, implement and project the main unitary operations and systems which compose manufacturing processes of fibrous materials (biomaterials, core and paper).
2. Ability to analyze and evaluate the physical, mechanical and optical properties about specific fibrous materials (biomaterials, core and paper).
3. Ability to develop new types of paper or paper products according to their specifications and specific technical applications.
4. Ability to select and evaluate various sources of vegetable fibers suitable for the manufacture of fibrous materials (biomaterials, pulp and paper) with certain technical characteristics.

### Teaching methodology

The teaching methodology is divided into three parts:
- Lectures presenting the subject content.
- Practical sessions
- Independent learning (self-study) and solving exercises by the students.

In lectures teachers introduce fundamentals of the subject, concepts and methods, illustrated with suitable examples to facilitate their understanding.

The practical sessions involve activities experimental practices in laboratory.

### Learning objectives of the subject

At the end of the course the student should:

Having the theoretical knowledge related to the properties and technological characteristics of the paper and composites, it studied as a fibrous physical structure.

Having the knowledge and skills to analyze, plan and design the processes for evaluating the physical-mechanical and optical properties of the fiber materials (pulp, paper, biomaterials and composite materials) from the theoretical and practical properties.

Having the knowledge and skills to perform the verification and control of facilities, processes and systems whose purpose is the evaluation of biomaterials and paper.
220230 - Physical Characterization of Biomaterials and Paper Products

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Hours small group:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time: 125h</td>
<td>30h</td>
<td>15h</td>
<td>80h</td>
</tr>
<tr>
<td></td>
<td>24.00%</td>
<td>12.00%</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
### Content

<table>
<thead>
<tr>
<th>Unit 1: Characteristics of paper as fibrous structure.</th>
<th>Learning time: 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h</td>
</tr>
</tbody>
</table>

**Description:**

<table>
<thead>
<tr>
<th>Unit 2: Basic properties of the paper.</th>
<th>Learning time: 9h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 6h</td>
</tr>
</tbody>
</table>

**Description:**
Basis weight, thickness, bulk density, factors affecting the density ratio between the density and other properties of the sheet.

**Related activities:**

<table>
<thead>
<tr>
<th>Unit 3: Porous structure of the paper. Fluid flow through the paper.</th>
<th>Learning time: 14h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 9h</td>
</tr>
</tbody>
</table>

**Description:**
Porous structure of the paper. Surface and internal porosity. Characterization of the porous structure of the paper. Pore size distribution. Influencing factors. As porosity. Relationship between the porosity and other properties of the sheet.
Fluid flow through the paper. Permeability measurement.

**Related activities:**
Experimental laboratory practices: Determination of air permeability of the papers. Air leakage methods (Bekk, Bendtsen and Gurley).
### Unit 4: Llisor i Rugositat.

**Learning time:** 5h  
Theory classes: 1h  
Laboratory classes: 1h  
Self study: 3h

**Description:**  
Measurement of smoothness. Factors affecting smoothness.

**Related activities:**  
Experimental laboratory practices: Determination of smoothness of the papers. Air leakage methods (Bekk, Bendtsen and Gurley). Determination of the coefficients of static and dynamic friction.

### Unit 5: Interactions between the paper and moisture.

**Learning time:** 11h  
Theory classes: 3h  
Self study: 8h

**Description:**  

### Unit 6: Strength properties of the paper

**Learning time:** 41h  
Theory classes: 9h  
Laboratory classes: 7h  
Self study: 25h

**Description:**  

**Related activities:**  
The final mark depends on the following evaluative acts:
- Activity 1 (midterm exam): 35%
- Activity 2 (Evaluation of laboratory practice through individual written reports and oral presentations): Evaluation of practical activities: 30%
- Activity 3 (final exam): 35%

The unsatisfactory result in the midterm exam (Activity 1) may be redirected by a written test on the day set for the final exam (Activity 3). Students who didn’t assist at the midterm exam (Activity 1) or with a grade lower than 5.0 in the midterm exam (Activity 1) can access this test. The grade obtained in the redirected test will replace the initial grade as long as it is higher.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.
220230 - Physical Characterization of Biomaterials and Paper Products

Bibliography

Basic:

Professors de l'assignatura. Apunts lliurats pel professorat.

Complementary: