220293 - Colorimetry, Dyes and Pigments

Degree competences to which the subject contributes

Specific:
1. Ability to apply multivariate analysis techniques in market knowledge about materials and textiles in order to implement a flow production system.
2. Ability to develop new fibers or yarns and woven and non-woven structures according to specifications and latest technologies for specific technical applications.
3. Ability to manage and optimize production processes of technical textiles.

Teaching methodology

The teaching methodology is divided into three parts:
- Face-to-face sessions for the presentation of contents, participation and exercises.
- Face-to-face lab work sessions.
- Self-study work and exercises and activities.

In the exposition - participation sessions of the contents, teacher will introduce the theoretical bases of the subject, concepts, methods and results illustrating them with suitable examples and requesting, if appropriate, the exercises to facilitate their understanding.

In the laboratory work sessions, the teacher will guide the students in the application of theoretical concepts for the resolution of experimental assemblages, based at all times critical reasoning. Activities will be proposed that the student will solve in the classroom and outside the classroom, to promote the contact and use of the basic tools necessary for the realization of an instrumentation system.

The student, autonomously, has to work the material provided by the faculty and the result of the work-problems sessions to assimilate and fix the concepts. Teachers will provide a study plan and activity monitoring (ATENEA).

Learning objectives of the subject

It enables the student to measure, analyze and reproduce color with the appropriate standardized models and acquire the fundamental knowledge of color science. The correct ordering, application of available softwares and communication of the color for use in the manufacturing processes and in the finished and related textile products, in view of their quality, as well as to carry out research, development and innovation in this field.

It trains the student for the proper selection of dyes and pigments according to their characteristics of chemical constitution, properties and relation with the color to complete the design of the textile product.

Knowledge of the particularities of presentation according to the needs of application of dyes and pigments in view of their rationalized use to achieve the quality required by the final product.

Knowledge of the environmental parameters of the coloring products and pigments used to ensure their good behavior regarding the environment.
# Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>24.00%</th>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>12.00%</td>
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<td>Self study:</td>
<td>80h</td>
<td>64.00%</td>
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<tr>
<td>Content</td>
<td>Learning time: 6h</td>
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| **(ENG) Mòdul 1: Fundamentals of Color Science** | Theory classes: 2h  
   Self study: 4h |
| **Description:** | 1.1. Definition of color.  
   1.2. Perception of color: appearance and attributes of color.  
   1.3. Light and color: definitions and units.  
   1.4. Visual perception of color: Physiology and spectral sensitivity of the retina of the eye and light and color received. |
| **(ENG) Module 2: Components in color perception** | Theory classes: 2h  
   Self study: 4h |
| **Description:** | 2.1 Light sources and illuminants. Methods for producing light.  
   2.2 Object: Modifications of the illumination by the objects.  
   2.3 Observer: Standardized observers. |
| **(ENG) Module 3: Systems for color management** | Theory classes: 2h  
   Self study: 4h |
| **Description:** | 3.1 Color Parameters  
   3.2 Measuring ladders  
   3.3 Systems based on perception  
   3.4 CIE Color Systems |
| **(ENG) Module 6: Color Differences** | Theory classes: 3h  
   Laboratory classes: 2h  
   Self study: 8h |
| **Description:** | 6.1 Equations normalized by the calculation of the color coordinates in the color spaces  
   6.2 Assessment of color differences  
   6.3 Methods of visual evaluation  
   6.4 Formulas by the measurement of the color differences in the color spaces  
   6.5 Measurement of whiteness and yellowing |
<table>
<thead>
<tr>
<th><strong>Module</strong></th>
<th><strong>Description</strong></th>
<th><strong>Learning time</strong></th>
<th><strong>Notes</strong></th>
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</table>
| **Module 7: Applying the Kubelka-Munk theory to textiles** | 7.1 Kubelka-Munk law (K-M)  
7.2 Application of K-M to textile materials  
7.3 Matching color with K-M law | **8h 30m**  
Theory classes: 2h  
Laboratory classes: 2h 30m  
Self study: 4h |  |
| **Module 4: Instrumental Color Measurement** | 4.1 Instruments for color measurement.  
4.2 Classification of instruments  
4.3 Spectrophotometers: Optical components; Measuring geometry and video cameras for color measurement. Preparation and presentation of samples.  
4.4 Colorimeters. | **6h**  
Theory classes: 2h  
Self study: 4h |  |
| **Module 9: Color and chemical constitution** | 9.1 Color theory: effects of the chemical groups of the dye molecule  
9.2 Color and chemical constitution and substantivitat: influential factors  
9.3 Theory of mesomeria  
9.4 Absorption and color | **11h**  
Theory classes: 2h  
Laboratory classes: 2h  
Self study: 7h |  |
**Module 10: Coloring materials**

**Learning time:** 22h
- Theory classes: 5h
- Laboratory classes: 2h
- Self study: 15h

**Description:**
- 10.1 Historical introduction: differentiation of natural and synthetic dyes
- 10.2 Classification of "Color Index"
- 10.3 Raw materials and intermediate products for the production of dyes: introduction to the industrial production of dyes
- 10.4 Commercial presentation of colorants
- 10.5 Classification of textile dyes
- 10.6 Pigments
- 10.7 Insoluble dyes
- 10.8 Soluble colorants
- 10.9 Importance of Synthetic Dyes and Affinity
- 10.10 Color fastness: dye fastness improvements
- 10.11 The ecology of colorants

**Module 11: Characteristics and properties of different types of dyes and pigments**

**Learning time:** 22h 30m
- Theory classes: 5h
- Laboratory classes: 2h 30m
- Self study: 15h

**Description:**
- 11.1 Etching dyes
- 11.2 Colorings premetalizats
- 11.3 Direct dyes
- 11.4 Acid dyes
- 11.5 Basic dyes
- 11.6 Sulphurous dyes
- 11.7 Colorants tub
- 11.8 Naftols colorants
- 11.9 Dyes Indigosols
- 11.10 Reactive dyes
- 11.11 Disperse dyes
- 11.12 Pigments
# Qualification system

- First evaluation: 35%
- Second evaluation: 35%
- Lab practices: 20%
- Presentation of a work: 10%

The unsatisfactory results of the partial exams can be redirected by means of a written test for each of them to be carried out on the day fixed by the final examination. This test can be accessed by all students enrolled. The grade of the test will be valued between 0 and 8. The grade obtained by the application of the renewal 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.

## Bibliography

### Basic:


### Complementary: