Course guide
205507 - 205507 - Processes to Improve the Optical Properties of Paper

Last modified: 11/04/2025

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 717 - DEGD - Department of Engineering Graphics and Design.

Degree: MASTER'S DEGREE IN PAPER AND GRAPHICS TECHNOLOGY (Syllabus 2020). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: Cristina Valls

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
MUTPIG-CE1. To be able to identify and assess raw materials, intermediate products and end products involved in the paper and graphic technologies.
MUTPIG-CE2. To be able to analyse and apply the main unit operations and manufacturing process systems involved in the field of the degree.
MUTPIG-CE3. To be able to apply environmental and sustainable technologies within the scope of the degree.
MUTPIG-CE6. To be able to analyze and evaluate theoretically and experimentally the structural, physical-mechanical and optical properties of materials in the paper and graphic field.

Generical:
MUTPIG-CG4. Carrying out research, development and innovation in the field of paper and graphic technologies.
MUTPIG-CG5. Technically and economically manage projects, companies and technology centers in the field of paper and graphic technologies.

Transversal:
CT4. 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.
CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Basic:
CB06. Manage original concepts in research projects.

TEACHING METHODOLOGY

The teaching methodology is divided into three parts:
- Face-to-face presentation sessions - participation in the contents and carrying out exercises.
- Face-to-face laboratory work sessions.
- Autonomous work of study and realization of exercises and activities.

In the exhibition sessions -participation of the contents, the teaching staff will introduce the theoretical bases of the subject, concepts, methods and results illustrating them with convenient examples and requesting, if necessary, the realization of exercises to facilitate their understanding.

In the laboratory work sessions, the teacher will guide the students in the application of the theoretical concepts for the resolution of experimental assemblies, basing at all times the critical reasoning. Activities to be solved by students in the classroom and outside the classroom will be proposed, in order to favor the contact and use of the basic tools necessary for the realization of an instrumentation system.

The student, autonomously, must work on the material provided by the teachers and the result of the work-problem sessions in order to assimilate and fix the concepts. Teachers will provide a study and activity monitoring plan (ATENEA).

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course the student must:
- Know the theoretical and practical foundations of the processes of deinking and bleaching of cellulosic fibers, as well as their unit operations.
- Know the technology of the processes of deinking by flotation and washing.
- Know the bleaching of different fiber sources, and the technology of the ECF and TCF bleaching processes.
- Have carried out the study of the efficiency of the different processes.
- Have performed an analysis of the properties of fibers and papers.
- To know the environmental aspects, the efficient use of water and the circuit closing of the different processes.

STUDY LOAD

Type	Hours	Percentage
Self study	80,0	64.00
Hours small group	45,0	36.00

Total learning time: 125 h

CONTENTS

Module 1: Improving the optical properties of recycled paper

Description:
Paper deinking
Bleaching of recycled fibres

Related activities:
Theory classes, laboratory practicals, partial exam.

Full-or-part-time: 48h
Laboratory classes: 18h
Self study : 30h

Module 2: ECF Bleaching Processes

Description:
General information on bleaching. Conventional bleaching. ECF bleaching. Delignification with oxygen. Bleaching with Chlorine Dioxide. Process variables.

Related activities:
Theory classes, laboratory practicals, partial exam, final exam.

Full-or-part-time: 37h
Laboratory classes: 13h
Self study : 24h

Module 3: TCF Bleaching Processes

Description:
Introduction to TCF bleaching. Ozone bleaching. Hydrogen peroxide bleaching. Process variables. Unit operations in a bleaching plant. Environmental impact of processes and their minimization.

Related activities:
Theory classes, laboratory practicals, final exam.

Full-or-part-time: 40h
Laboratory classes: 14h
Self study : 26h

ACTIVITIES

Activity 1: Theory classes

Description:
Presentation of the contents of the subject following a model of participatory expository class.
The subject has been organized into 3 thematic areas and within these areas there are different topics, as shown in the modules presented in the contents of this guide.
The evaluation of this activity will be through the partial and final exams. There will also be evaluation questionnaires at Athena for each of the topics explained in class.
Related activities:
Partial and final exam

Full-or-part-time: 44h
Self study: 30h
Laboratory classes: 14h

Activity 2: Laboratory Practicals

Description:
The following laboratory practicals related to the contents of the subject will be carried out:
P1. Paper deinking
P2. Bleaching of recycled fibers
P3. ECF bleaching sequence
P4. TCF bleaching sequence
P5. Analysis of pulp properties. Analysis of the optical properties of papers
For each of the practicals, the student must submit an individual report. It is a necessary condition to pass the subject the realization of the laboratory practicals and to deliver the corresponding reports. An oral presentation of the practical contents will also be performed.
The practicals will be evaluated according to the attendance and participation in the sessions, according to the reports made and according to the oral presentation made.

Full-or-part-time: 75h
Self study: 50h
Laboratory classes: 25h

Activity 3: Partial Exam

Description:
Development of the partial exam of the subject
Related activities:
Theory classes

Full-or-part-time: 3h
Laboratory classes: 3h

Activity 4: Final Exam

Description:
Development of the final exam of the subject
Related activities:
Theory classes

Full-or-part-time: 3h
Laboratory classes: 3h

GRADING SYSTEM

The global grade of the subject (GG) will be the result of the following weighted calculation:
NG = 0.30 x EV1P (Partial) + 0.30 x EV1F (Final) + 0.20 x EV2 + 0.05 x EV3 + 0.05 EV4 + 0.10 EV5
where,
- EV1. Written or oral tests to evaluate individual knowledge (activities 3 and 4 of this guide)
- EV2. Evaluation of practical work by means of deliverable reports (activity 2 of this guide)
- EV3. Attendance and participation in the practical sessions (activity 2 of this guide)
- EV4. Evaluation of individual work (activity 1 of this guide corresponding to the Atenea questionnaires)
- EV5. Written and / or oral presentations related to the contents of the subject (activity 2 of this guide, oral presentations of laboratory practicals)

The unsatisfactory result of the first partial (EV1P) will be able to redirect by means of a written test to realize the day fixed by the final exam (EV1F). Students who do not appear in the first part or with a grade lower than 5.0 in the first part can take part in this test. The grade obtained by the application of the renewal will be beatween 0 and 10 and will replace the initial grade as long as it is higher.

For those students who meet the requirements and take the re-assessment exam, the grade of the re-assessment exam will replace the marks of all the assessment acts that are face-to-face written tests (partial and final exams) and will be maintained the qualifications of practicals, reports, questionnaires and presentations obtained during the course. If the final grade after the revaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after the re-assessment is greater than or equal to 5.0, the final grade of the subject will be passed 5.0.

BIBLIOGRAPHY

Basic:
- Colom, José F; Torres, Antonio L. El destintado del papel. Terrassa: UPC. ETSIIT, DL 1991. ISBN 8476531141.
- García Hortal, J.A., Vidal Llucià, T. Blanqueo de pastas papeleras. Terrassa: UPC, 1984.
- Dence, Carlton W.; Reeve, Douglas W. Pulp bleaching: principles and practice. Atlanta, Georgia: TAPPI, 1996. ISBN 0898520630.

Complementary:
- Bajpai, Pratima. Environmentally friendly production of pulp and paper. Hoboken, NJ: Wiley, cop. 2010. ISBN 9780470528105.
- Springer, Allan M. Industrial environmental control: pulp and paper industry. 3rd ed. Atlanta, Georgia: TAPPI, cop. 2000. ISBN 1930657552.

RESOURCES

Other resources:
Teacher's notes deposited in ATENEA.