Course guide
205503 - 205503 - Paper Fibers Obtaining Technology

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-CE4. To be able to select and evaluate the different sources of vegetable fibers suitable for the manufacture of paper products with specific technical properties.

Generical:
MUTPIG-CG1. Applying mathematical, analytical, scientific, instrumental and technological knowledge, related to the field of paper and graphic technologies.

Transversal:
CT1. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.

Basic:
CB09. Improve technical communication of results.

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 structure and morphological, physical and chemical characteristics of cellulosic fiber.
- Know the theoretical and practical foundations of the processes of obtaining fibers.
- Know the existing technologies, process variables and equipment used in the processes of obtaining fibers.
- Know the environmental impact of the processes of obtaining fibers and the techniques and equipment used in the recovery of chemical products.
- Know how to classify the different sources of vegetable fibers.
- Know the structure of the different types of wood.
- Know how to identify the different types of wood and non-wood fibers.
- Know how to identify the fibrous composition of pulp and paper.

STUDY LOAD

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

Total learning time: 125 h

CONTENTS

Module 1: Chemical composition of lignocellulose

Description:
Elemental composition of plants. Main constituents (Cellulose, Hemicelluloses and Lignin).
Minor components: nature and impact on pulp and paper manufacturing processes.
Plant fiber.

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

Full-or-part-time: 25h
Laboratory classes: 9h
Self study : 16h

Module 2: Pulping processes

Description:
Introduction to the pulping processes
Sulfate or kraft process
Other pulping processes: sulfite process, mechanical process, etc ...

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

Full-or-part-time: 60h
Laboratory classes: 22h
Self study : 38h

Module 3: Identification of paper fibers

Description:
Introduction to plant fiber sources
Morphological characteristics and identification of wood fibers
Morphological characteristics and identification of non-wood fibers
Fibrous composition of pulp and paper. Quantitative analysis of fibers in pulp and paper mixtures

Related activities:
Theory classes, microscopy 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 Atenea for each of the topics explained in class.

Related activities: Partial and final exam

Full-or-part-time: 54h
Self study: 36h
Laboratory classes: 18h

Activity 2: Laboratory Practicals

Description:
The following laboratory practicals related to the contents of the subject will be carried out:
P1. Chemical composition of lignocellulose (extracts, wood density, ash, holocellulose, etc ...)
P2. Kraft pulping: obtaining white liquors, titration of white liquors, kraft pulping. Process evaluation (yield, shives, black liquors, etc ...)
P3. Mechanical pulping process. Process evaluation (yield)
P4. Characterization of the obtained pulps (kappa number, viscosity, brightness)
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 practicals of laboratory and present the corresponding reports. There will also be an oral presentation of the practical contents.
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: 48h
Self study: 32h
Laboratory classes: 16h

Activity 3: Microscopy Practicals

Description:
There will be several microscopy sessions where the student will learn to:
- Identify the different types of wood and non-wood fibers under the microscope.
- Identify the fibrous composition of pulp and paper
- Quantitatively analyze the fibrous composition of a fiber mixture.
The evaluation of this activity will be carried out by attending and participating in the sessions and by means of a test where the student will have to identify the fibrous composition of different unknown samples.

Full-or-part-time: 17h
Self study: 12h
Laboratory classes: 5h

Activity 4: Partial Exam

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

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

Activity 5: 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 (NG) will be the result of the following weighted calculation:
NG = 0.3 x EV1P (Partial) + 0.3 EV1F (Final) + 0.2 x EV2 + 0.05 x EV3 + 0.05 x EV4 + 0.1 x EV5
where,
- EV1. Written or oral tests to control individual knowledge (activities 4 and 5 of this guide)
- EV2. Evaluation of practical work by means of deliverable reports (activity 2 and 3 of this guide)
- EV3. Attendance and participation in the practical sessions (activity 2 and 3 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 be redirected by means of a written test to realize the day fixed by the final exam (EV1F). This test is open to students who do not appear in the first part or with a grade of less than 5.0 in the first part. The grade obtained by the application of the renewal will be between 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 practical grades, 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:
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- García Hortal J.A.; Colom Pastor, J.F. El proceso al sulfato. Vol.1, Introducción, aspectos químicos de la cocción [on line]. 2a ed. Terrassa: Universitat Poltècnica de Catalunya, 1992- [Consultation: 23/01/2023]. Available on: http://hdl.handle.net/2099.3/36487. ISBN 8476531990.
- García Hortal, J.A. Fibras papeleras. Barcelona: Universitat Politècnica de Catalunya, 2007. ISBN 9788483019160.
- Sjöström, Eero. Wood chemistry: fundamentals and applications. 2nd ed. San Diego: Academic Press, 1993. ISBN 9780126474817.

Complementary:
- Casey, James P. Pulpa y papel: química y tecnología química. Vol.1. México: Limusa, 1990. ISBN 9681820614.
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- Kellomäki, Seppo. Forest resources and sustainable management. 2nd ed. Helsinki: Paper Engineer's Association/Paperi ja Puu Oy, cop. 2009. ISBN 9789525216325.
- Sundholm, Jan. Mechanical pulping. Helsinky: Fapet Oy, cop. 1999. ISBN 9525216055.
- Gullichsen, Johan; Fogelholm, Carl-Johan; McLeod, Martin. Chemical pulping. Helsinki: The Finnish Paper Engineers' Association : TAPPI, cop. 1999-2008. ISBN 9525216063.
- Rydholm, Sven A. Pulping processes. Malabar, Fla.: R.E. Krieger, 1985. ISBN 0898748569.

RESOURCES

Other resources:
Teacher's notes deposited in ATENEA.