Course guide
320192 - ITIPG - Introduction to Industrial Paper and Graphics Technologies

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

Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Roncero Vivero, Maria Blanca

Others: Roncero Vivero, Maria Blanca
Valls Vidal, Cristina
Cusola Aumedes, Oriol
Galea Martínez, Silvia

PRIOR SKILLS

It is not contemplated that the student has any special previous training, due to the specific character of the subject.

TEACHING METHODOLOGY

The course is organized by combining theory classes, laboratory practicals, and visit to factories.
- Face-to-face sessions of presentation of the contents and resolution of exercises.
- Group practical sessions in the laboratory.
- Visit to a factory and / or seminar in paper, conversion and printing sectors.
- Autonomous work of study and realization of exercises.

In the content presentation sessions, the theoretical bases of the subject, concepts, methods and results will be introduced, illustrating them with convenient examples to facilitate their understanding.
In the sessions of practical work in laboratory and the visits to factory and / or seminar will center in the taking of contact of the student with the main technicians of manufacture of pastes, paper and impressesion, as well as some of the essays of control of quality commonly used in industry.
Students will have to study independently in order to assimilate the concepts.

LEARNING OBJECTIVES OF THE SUBJECT

The aim of this course is that students know the different processes required to obtain paper. During the subject, the student will know the different sources of paper fibers, how these fibers can be extracted from plants and the manufacture of paper from them. The different printing processes will also be exposed.
Theoretical classes will be combined with practical laboratory sessions in order to better consolidate learning.

STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	20.00
Self study	90,0	60.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

Module 1: Introduction to the pulp and paper manufacturing industry. Raw materials

Description:
Overview of the paper and graphics industry: sectors, characteristics and statistical data. Paper definition. Raw materials.

Full-or-part-time: 9h
Theory classes: 4h
Self study : 5h

Module 2: Pulp obtaining technologies

Description:
Main processes of obtaining pulp. Technologies and process control. Closing circuits. New technologies

Related activities:
Exhibition of theoretical contents by teachers with the active participation of the students.
Study, work and personal analysis

Full-or-part-time: 13h
Theory classes: 6h
Self study : 7h

Module 3: Paper Manufacturing Technologies

Description:
General scheme of a paper mill. Characteristics of the preparation circuits for pulp: Disintegration and refining. Characteristics of the preparation circuits for recovered paper: Debugging and deinking. Head machine circuits. Sheet formation systems. Wet pressing. Paper drying. Paper finishing. Paper handling and conversion.

Related activities:
Exhibition of theoretical contents by teachers with the active participation of the students
Study, work and personal analysis

Full-or-part-time: 17h
Theory classes: 6h
Self study : 11h

Module 4: Paper Analysis and Properties

Description:
Paper as a fibrous structure: Anisotropies DM, DT and DZ. Basic properties of paper: Weight, thickness, bulk density. Porous structure of paper. Paper strength properties. Optical properties. Durability

Related activities:
Exposición de contenidos teóricos por parte del profesorado con la participación activa de los estudiantes
Estudio, trabajo y análisis personal

Full-or-part-time: 11h
Theory classes: 4h
Self study : 7h

Module 5: Printing Technologies

Description:
Introduction to the graphic sector. Future perspective in R + D + I. Brief historical summary. Terminology. Production flow in the graphic sector. First classification of the different systems: Conventional printing systems. NIP or digital printing systems. Characteristics of the elements that compose them.

Related activities:
Exhibition of theoretical contents by teachers with the active participation of students. Study, work and personal analysis

Full-or-part-time: 17h
Theory classes: 6h
Self study : 11h

Module 6: Lignocellulosic biorefineries

Description:
Concepts of biorefinery. 1st and 2nd generation biorefineries. Biotechnology applied to paper processes

Full-or-part-time: 12h
Theory classes: 4h
Self study : 8h

Practical 1: Introduction to experimentation in pulp, paper and graphics laboratories

Description:
General presentation of the equipment and specific experimental techniques in the laboratories of the specialty. Determination of the consistency of a suspension

Related activities:
Practical work individually or in group, in the laboratory or pilot plant
Study, work and personal analysis

Full-or-part-time: 4h
Laboratory classes: 2h
Self study : 2h

Practice 2: Identification of raw materials

Description:
Cellulosic fibers of different origin will be identified under a microscope . Fibrous composition of a paper

Related activities:
Practical work individually or in group, in the laboratory or pilot plant
Study, work and personal analysis

Full-or-part-time: 5h
Laboratory classes: 2h
Self study : 3h

Practice 3: Chemical-mechanical treatments of raw materials

Description:
Chemical-mechanical treatments of raw materials. Characterization of fibers. Make paper sheets. Determination of properties.

Related activities:
Practical work individually or in group, in the laboratory or pilot plant
Study, work and personal analysis

Full-or-part-time: 12h
Laboratory classes: 4h
Self study : 8h

Practice 4: Paper surface treatments.

Description:
Chemical and mechanical treatments of papers. Evaluation of surface properties

Related activities:
Practical work individually or in group, in the laboratory or pilot plant
Study, work and personal analysis

Full-or-part-time: 11h
Laboratory classes: 6h
Self study : 5h

Practice 5: Physical-mechanical characterization of paper sheets. Determination of optical properties

Description:
Characterization in the laboratory of the laboratory sheets obtained. Weight. Thickness. Specific density and volume. Air permeability (Bendtsen method), Traction-elongation rheograms. Burst resistance. Optical properties.

Related activities:
Practical work individually or in group, in the laboratory or pilot plant
Study, work and personal analysis

Full-or-part-time: 11h
Laboratory classes: 4h
Self study : 7h

Practice 6: CADSIM simulator

Description:
Basic aspects of the CADSIM simulator. Case study.

Related activities:
Individual or group practical work, carried out in the classroom or in the laboratory
Study, work and personal analysis

Full-or-part-time: 8h
Laboratory classes: 4h
Self study : 4h

Practice 7: Ability of papers for printing

Description:
The practice is to obtain a transfer curve DO = f (amount of ink), in order to determine the minimum amount of ink to obtain a good optical performance in three different media. IGT printing equipment is used, and the importance of the morphology of the medium (stucco, smooth ...) in the amount of ink required is highlighted.

Related activities:
Practical work individually or in group, in the laboratory.
Study, work and personal analysis

Full-or-part-time: 9h
Laboratory classes: 4h
Self study : 5h

Visits to factories in paper, conversion, and graphic sectors.

Description:
Visit to paper mills, graphic arts conversion, with the aim of making an approach to the industrial reality of these manufacturing processes

Related activities:
Visits to companies,
Attendance at specific seminars
Study, work and personal analysis

Full-or-part-time: 11h
Laboratory classes: 4h
Self study : 7h

GRADING SYSTEM

The final grade of the course depends on the following assessment criteria:
- First partial written exam: 30%
- Final written exam: 30%
- Evaluation of group work activities, laboratory practicals, factory visit and / or seminar, presentation of reports: 30%
- Oral presentation of works, practical laboratory activities, visit to factory and / or seminar: 10%

The unsatisfactory result of the first part can be redirected by means of a written test to be carried out on the day set for the final exam. 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 replace the initial grade as long as it is higher.

BIBLIOGRAPHY

Basic:
- Ek, M.; Gellerstedt, G.; Henriksson, G. (eds.). Pulp and paper chemistry and technology, vol. 1, Wood chemistry and wood biotechnology. Berlin: De Gruyter, cop. 2009. ISBN 9783110213393.
- Ek, M.; Gellerstedt, G.; Henriksson, G. (eds.). Pulp and paper chemistry and technology, vol. 2, Pulping chemistry and technology. Berlin: De Gruyter, cop. 2009. ISBN 9783110213416.
- Ek, M.; Gellerstedt, G.; Henriksson, G. (eds.). Pulp and paper chemistry and technology, vol. 3, Paper chemistry and technology. Berlin: De Gruyter, cop. 2009. ISBN 9783110213430.
- Smook, Gary A. Handbook for pulp & paper technologists. 3rd ed. Vancouver [etc.]: Angus Wilde, cop. 2002. ISBN 0969462859.
- Ek, M.; Gellerstedt, G.; Henriksson, G. (eds.). Pulp and paper chemistry and technology, vol. 4, Paper products physics and technology. Berlin: De Gruyter, cop. 2009. ISBN 9783110213454.