# Course guide
# 320077 - DELLNT - Design of Linear and Nonwoven Laminar Structures

**Last modified:** 11/04/2025

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering
**Teaching unit:** 702 - CEM - Department of Materials Science and Engineering.

**Degree:** BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Compulsory subject).

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

## LECTURER

**Coordinating lecturer:** Cano Casas, Francesc

**Others:**

## PRIOR SKILLS

Previously studying the subject Materials for Textile Product Design is highly desirable.

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
CE22-GETDT. Knowledge of linear textile structures and nonwoven fabrics. Spinning operations. (Specific Technology Module: Textile)

**Transversal:**
CT04 N3. Teamwork - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

## TEACHING METHODOLOGY

· Presential lecturing sessions for delivery of the topics with active student involvement.
· Presential sessions of practical work.
· Self-directed study and preparation of deliverables; spinning development project; technical study of various non-woven laminates. Cooperative learning.
· Preparation and completion of assessable teamwork activities.

## LEARNING OBJECTIVES OF THE SUBJECT

GLO1. To become acquainted with spinning techniques and processes.
GLO2. To be able to select the most suitable spinning process for each type of yarn in terms of applications and technical and economic requirements.
GLO3. To develop specific and transversal skills associated with the academic work.
GLO4. To acquire the ability to identify non-woven laminates, and knowledge of their manufacturing processes, applications and technical specifications.

## STUDY LOAD

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

**Total learning time:** 150 h

## CONTENTS

### Topic 1: CHARACTERIZATION OF YARNS

**Description:**
1.1. Yarn numering.
1.2. Consolidation of a yarn structure by twisting.
1.3. Yarn strength and stretching.
1.4. Mass irregularity indices.
1.5. Yarn hairiness.
1.6. Fundamentals of yarn friction.

**Specific objectives:**
SO1. To learn the main yarn parameters.
SO2. To learn the technical specifications for each yarn parameter as a function of intended use for the end product.
SO3. To understand industrial problems arising from variability in yarn parameters.
SO4. To learn the methodology for identifying faults in yarns produced by the different spinning machine types.

**Related activities:**
Theory classes, problem solving, laboratory practice and exam

**Full-or-part-time:** 50h
Theory classes: 10h
Laboratory classes: 10h
Self study : 30h

**Topic 2: SHORT-FIBRE SPINNING SYSTEMS**

**Description:**
2.1. Basic spinning calculations.
2.2. Technical study of the main short-fibre spinning systems.
2.3. Structural properties of the yarns produced by each type of spinning system and influence on their weaving, dyeing and/or finishing. Winding of yarns as a function of their technical weaving and/or dyeing requirements.
2.4. Criteria for selection of short-yarn types in accordance with the technical specifications of the target fabric.
2.5. Development of an operation plan. Production and quality management. Development of an integral short-fibre spinning process.

**Specific objectives:**
SO5. To learn the main calculations for spinning processes.
SO6. To understand the different ways of obtaining short fibres depending on their intended use.
SO7. To understand the structural differences between yarns produced by different short-fibre spinning systems and their relationship to the end product.
SO8. To be able to design a short-fibre spinning operation plan, and to manage its production and quality related aspects.

**Related activities:**
Theory classes, problem solving, laboratory practice and exam

**Full-or-part-time:** 50h
Theory classes: 10h
Laboratory classes: 10h
Self study : 30h

**Topic 3: LONG-FIBRE SPINNING SYSTEMS**

**Description:**
3.1. Technical study of the main long-fibre spinning systems.
3.2. Transformation of chemical fibre wires correctly into cut fibres.
3.3. Structural properties of yarns produced by different types of spinning systems and influence on their weaving, dyeing and/or finishing.
3.4 Criteria for selection of long-yarn types in accordance with the technical specifications of the target fabric.
3.5. Development of an operation plan for the production of long fibres.
3.6. Similarities and differences between short- and long-fibre yarn production processes.
3.7. Texturing technology. Advantages and disadvantages of each texturing system in terms of the intended textile use of the end product. Textured yarn control.

**Specific objectives:**
SO9. To learn the different ways of producing yarns for long-fibre spinning depending on their intended use.

SO10. To understand the structural differences between yarns produced by long-fibre spinning systems and their influence on the characteristics of the end product.

SO11. To be able to develop a operation plan for a long-fibre spinning process and manage its production and quality aspects, and to understand the similarities and differences between short- and long-fibre spinning processes.
SO12. To understand texturing technology.

**Related activities:**
Theory classes, problem solving, laboratory practice and exam

**Full-or-part-time:** 14h
Theory classes: 3h
Laboratory classes: 2h
Self study : 9h

### Topic 4 : NON-WOVEN LAMINATES

**Description:**
4.1 Fibre types. Fundamentals of webbing and lapping. Technical features and properties.
4.2 Adaptation of conventional carding techniques for the production of non-woven laminates with the dry method.
4.3 Aerodynamic webbing methods. Characteristics, properties, performance and uses of the products.
4.4 Wet consolidation of laminates. Advantages and disadvantages.
4.5 Production of non-woven laminates by melting. Comparison with other systems.
4.6 Web consolidation by punching. Descriptive study of punching equipment. Comparison with other consolidation systems.
4.7 Consolidation by melting in the presence or absence of pressure.
4.8 Chemical consolidation. Most suitable binders and application methods. Comparison with other systems.
4.9 "Tufting". Loop or hair formation. Machinery. Product performance and usage fields.

**Specific objectives:**
SO13. To learn the different ways of obtaining non-woven laminates according to the particular technological requirements.
SO14. Comparative technical and commercial study of different available methods.
SO15. Analysis of non-woven laminates and their production.

**Related activities:**
Theory classes, problem solving, laboratory practice and exam

**Full-or-part-time:** 22h
Theory classes: 4h
Laboratory classes: 6h
Self study : 12h

### THEME 5: CHEMICAL FIBER SPINNING SYSTEMS

**Description:**
1. Fusion spinning.
2. Dry spinning.
3. Wet spinning.
4. Drafting post-spinning.
5. Stabilization.
6. Spinning finishes.
7. Textured Systems

**Specific objectives:**
1. Know different systems for extruding chemical fibers.
2. Know the different post-extrusion operations and their relationship with the physical parameters obtained.

**Related activities:**
Theory classes, problem solving, laboratory practice and exam

**Full-or-part-time:** 14h
Theory classes: 3h
Laboratory classes: 2h
Self study : 9h

## GRADING SYSTEM

Written tests (First evaluation: 30%, Second evaluation: 30%)
Practices: 20%
Labor: 20%

To pass the course, a resulting grade equal to or greater than five must be obtained. Students who have failed the first partial exam will be able to opt, by notifying the teacher, for a recovery / reconduction exam. The recovery / reconduction of the first partial exam will be carried out with a written test, on the day of the second partial exam, after it, with a maximum grade of 5.0. The grade obtained will replace the initial grade only if it is higher.

For those students who meet the requirements and take the re-evaluation exam, the grade of the re-evaluation exam will replace the marks of all the evaluation acts that are face-to-face written tests (controls, midterms and final exams) and will be maintained the qualifications of practices, works, projects and presentations obtained during the course.
If the final grade after the re-evaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after the re-evaluation is greater than or equal to 5.0, the final grade for the course will be approved 5.0.

## BIBLIOGRAPHY

**Basic:**
- Marsal Amenós, F. Operaciones básicas de hilatura: caracterización de los hilos: procedimientos de ensayo y valores de experiencia. Terrassa: EUETIT, 2004.
- Marsal Amenós, F. Cálculos básicos en hilatura [on line]. Terrassa: Universitat Politècnica de Catalunya, 2017 [Consultation: 24/10/2024]. Available on: http://hdl.handle.net/2099.3/39977.
- Marsal Amenós, F. Gestión de la producción y de la calidad en la hilatura de fibras largas [on line]. 3a ed. Alcoy: AITEX, 2001 [Consultation: 25/05/2020]. Available on: http://hdl.handle.net/2099.3/39978. ISBN 849301558X.
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- Lawrence, Carl A. Fundamentals of spun yarn technology. Cambridge: CRC Press, 2003. ISBN 9781566768214.
- Sen, Amartya Kumar. Coated textiles: principles and applications. Lancaster: Technomic, 2001. ISBN 1587160234.
- Albrecht, Wilhelm [et al.]. Nonwoven fabrics. Weinheim: Wiley-VCH, 2003. ISBN 3527304061.