Course guide
205553 - 205553 - Advances in Fibres and Threads

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

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

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

LECTURER

Coordinating lecturer: Coordinador: Monica Ardanuy

Others: Tornero García, José Antonio
Cano Casas, Francesc

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
MUDITT-CE1. The ability to identify the properties of technical fibres and yarns and apply their production technologies.

Generical:
CG3. Lead, plan and supervise multidisciplinary teams.
MUDITT-CG1. Apply mathematical, analytical, scientific, instrumental, technological and management knowledge related to the field of textile design and technology.
MUDITT-CG2. Project, calculate and design products and processes related to the field of textile design and technology.
MUDITT-CG4. Carry out research, development and innovation in the field of textile design and technology.
MUDITT-CG5. Carry out strategic planning and apply it to production, quality and environmental management systems in the field of textile design and technology.

Transversal:
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.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Basic:
CB06. Manage original concepts in research projects.
CB07. Student capacity to use their knowledge in new and multidisciplinary situations.
CB08. Generate decision from incomplete information assuming its social and ethical responsibilities.
CB09. Improve technical communication of results.
CB10. Improve self-learning capacity

TEACHING METHODOLOGY

The teaching methodology is based on:
- Face-to-face sessions of presentation of the contents and problem-solving exercises.
- Face-to-face laboratory work sessions.
- Autonomous work of study and realization of exercises and activities.

In the sessions of presentation-participation of the contents, the professor will introduce the theoretical bases of the matter, concepts, methods and results illustrating them with convenient examples and requesting, if necedssary, the realization of exercises, to facilitate his comprehension.
In the laboratory work sessions, the teacher will guide the students in the application of the theoretical concepts for the resolution of experimental questions, based at all times on critical reasoning. Activities will be proposed that the student solves in the classroom and outside the classroom, to favor the contact and use of the basic tools necessary for the realization of an instrumentation system.
Students, autonomously, have to work on the material provided by the teachers and the result of the work-problem sessions 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 be able to:
- To know the most important characteristics and properties of the latest developments related to fibers, yarns, and fabrics for applications in textiles for technical use.
- Understand and characterize textile materials according to technical and quality criteria.

STUDY LOAD

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

Total learning time: 125 h

CONTENTS

Lesson 1: Introduction and general considerations on advances in textile fibers

Description:
1.1. Introduction to advances in textile fibers: general classification of fibers, production processes, chemical composition, and morphology and properties

Related activities:
AF1. Theoretical work sessions in the classroom
AF4. Preparation and performance of assessable individual or group activities
AF5. Autonomous study work and exercises
AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 2h
Laboratory classes: 1h
Self study : 1h

Lesson 2: High performance fibers

Description:
2.1. Introduction to high-performance fibers
2.2. High modulus and toughness fibers: Polyethylene HP, Polyamide HP, Polyester, HP and others
2.3. Heat-resistant fibers: aramids, polybenzoazoles, other organic polymer fibers, thermoset polymer fibers, carbon fibers, glass fibers, metal fibers, ceramics and others
2.4. Flame retardant fibers

Related activities:
AF1. Theoretical work sessions in the classroom
AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
AF3. Practical work sessions in the laboratory
AF4. Preparation and performance of assessable individual or group activities
AF5. Autonomous study work and exercises
AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 30h
Laboratory classes: 10h
Self study : 20h

Lesson 3: Recycled fibres

Description:
3.1. Introduction to fiber recycling
3.2. Mechanical recycling
3.3. Thermomechanical recycling
3.4. Chemical recycling
3.5. Other types of fiber recycling

Related activities:
AF1. Theoretical work sessions in the classroom
AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
AF3. Practical work sessions in the laboratory
AF4. Preparation and performance of assessable individual or group activities
AF5. Autonomous study work and exercises
AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 6h
Laboratory classes: 2h
Self study : 4h

Lesson 4: Fibers based on biopolymers

Description:
4.1. Introduction to biopolymers
4.2. Fibers obtained from polymers from biomass: based on polysaccharides or proteins
4.3. Fibers obtained from monomers from biomass
4.4. Bast fibers
4.5. Other biofibers

Related activities:
AF1. Theoretical work sessions in the classroom
AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
AF3. Practical work sessions in the laboratory
AF4. Preparation and performance of assessable individual or group activities
AF5. Autonomous study work and exercises
AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 16h
Laboratory classes: 6h
Self study : 10h

Lesson 5: Introduction to technical yarns

Description:
5.1. Introduction to yarns for technical applications: classification according to performance criteria, functionality, structure and manufacturing process

Related activities:
AF1. Theoretical work sessions in the classroom
AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
AF3. Practical work sessions in the laboratory
AF4. Preparation and performance of assessable individual or group activities
AF5. Autonomous study work and exercises
AF6. Tutoring and formative evaluation of the learning process

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

Lesson 6: Innovation in technical application threads

Description:
6.1. Evolution of threads for technical applications, conductive threads, High Modulus, High Tenacity Yarns, hybrid and composite threads, threads for medical application (suture), biodegradable threads, fancy, coated threads, threads of novel materials.
6.2. Innovations and latest trends in the development of yarns for technical use

Related activities:
AF1. Theoretical work sessions in the classroom
AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
AF3. Practical work sessions in the laboratory
AF4. Preparation and performance of assessable individual or group activities
AF5. Autonomous study work and exercises
AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 35h
Laboratory classes: 13h
Self study : 22h

Lesson 7: Production processes of the threads of technical application

Description:
7.1. Production processes for threads of technical application, coating processes, hair modification, structure obtained, production of thin threads and new materials
7.2. Thread development techniques for technical applications with improved properties or new functionalities
7.3. Characterization and quality in threads for technical applications, tests and regulations

Related activities:
AF1. Theoretical work sessions in the classroom
AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
AF3. Practical work sessions in the laboratory
AF4. Preparation and performance of assessable individual or group activities
AF5. Autonomous study work and exercises
AF6. Tutoring and formative evaluation of the learning process

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

GRADING SYSTEM

Exam 1: 20%
Exam 2: 20%
Exercises and practical cases: 30%
Reports of laboratory work: 30%.
For those students who meet the requirements and take the reevaluation exam, the grade of the reevaluation exam will substitute the marks of all the evaluation acts that are face-to-face written tests (controls, midterms and final exams) and the practical grades will be maintained: laboratory reports, exercises and presentations obtained during the course.
If the final grade after the reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after the reevaluation is greater than or equal to 5.0, the final grade for the course will be 5.0.

BIBLIOGRAPHY

Basic:
- Hearle, J.W.S. High-performance fibres. Cambridge: Boca Raton: Woodhead; CRC, cop. 2001. ISBN 1855735393.
- Hongu, Tatsuya; Phillips, Glyn O.; Takigami, Machiko. New millennium fibers. Boca Raton [etc.]: Woodhead/CRC, cop. 2005. ISBN 1855736012.
- Horrocks, A.R.; Anand, S. Handbook of technical textiles [on line]. 2nd ed. Cambridge UK: Woodhead Publishing; Textile Institute, 2016 [Consultation: 04/11/2022]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9781782424581/handbook-of-technical-textiles.
- Bunsell, A. R. Handbook of tensile properties of textile and technical fibres. Cambridge: Boca Raton: Woodhead; CRC, 2009. ISBN 9781845693879.
- Brown, P. J; Stevens, K. Nanofibers and nanotechnology in textiles. Boca Raton [etc.]: Cambridge: CRC; Woodhead, 2007. ISBN 9781845691059.
- Blackburn, R. S. Biodegradable and sustainable fibres. Boca Raton, (etc.): CRC: Woodhead publishing limited, cop. 2005. ISBN 185573916X.
- Alagirusamy, R; Das, A. Technical textile yarns: industrial and medical applications. Boca Raton, FL: Oxford: CRC Press; Woodhead Publishing Limited, cop. 2010. ISBN 9781845695491.

RESOURCES

Other resources:
ALGUNES WEBS D'INTERÈS:
- http://www.innovationintextiles.com />- http://www.techtextil.com/