

Course guide 205558 - 205558 - Instrumental Techniques for Research and Development

Unit in charge: Teaching unit:	Terrassa School of Industrial, Aerospace and Audiovisual Engineering 702 - CEM - Department of Materials Science and Engineering.
Degree:	MASTER'S DEGREE IN TEXTILE DESIGN AND TECHNOLOGY (Syllabus 2020). (Compulsory subject).
Academic year: 2024	ECTS Credits: 5.0 Languages: Spanish, English

LECTURER

Coordinating lecturer: Diana Cayuela

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

MUDITT-CE6. The ability to properly use analytical techniques for research and development activities within the field of textile design and technology.

Generical:

MUDITT-CG1. Apply mathematical, analytical, scientific, instrumental, technological and management knowledge 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.

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.

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 divided into three parts:

 $\hat{a} \Box \Box$ Face-to-face sessions of exposition - participation of the contents and performance of exercises.

 $\hat{a} \Box \Box$ Face-to-face sessions of laboratory work.

 $\hat{a} \Box \Box$ Autonomous study work and carrying out exercises and activities.

In the lecture-participation sessions of the contents, the teacher will introduce the theoretical bases of the subject, concepts, methods and results, illustrating them with suitable examples and requesting, if necessary, the performance of exercises to facilitate their understanding.

In the laboratory work sessions, the teaching staff will guide students in the application of theoretical concepts to the resolution of experimental set-ups, basing critical reasoning at all times. Activities will be proposed for students to carry out in the classroom and outside the classroom, in order to encourage contact and use of the basic tools necessary for the creation of an instrumentation system.

The students, in an autonomous way, have to work on the material provided by the teaching staff and the result of the work-problem sessions in order to assimilate and fix the concepts. The teaching staff will provide a study and activity monitoring plan (ATENEA). Attendance in practical classes is compulsory.



LEARNING OBJECTIVES OF THE SUBJECT

1. To know how the properties of the textile materials vary in the manufacturing process depending on the manufacturing parameters and on the study of the microstructure of textile fibres.

2. To know the analytical techniques for determining the microstructure of textile fibres.

3. To know the fundamentals of spectroscopic and chromatographic analytical techniques and the qualitative and quantitative information that they provide.

4. To know when the different analytical techniques can be applied.

5. To be able to select the most appropriate technique to solve a specific problem.

STUDY LOAD

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

Total learning time: 125 h

CONTENTS

Module 1: Microstructure of synthetic fibres

Description:

The microstructure of synthetic fibres based, mostly, on the importance of the crystallinity and orientation is described. Also how these properties change with the variables of the textile process and its impact on the properties of the substrates is analysed.

Related activities:

Presentation of the theoretical contents by the lecturer with the active participation of the students. Resolution by the student of exercises, problems and practical cases. Personal study, work and analysis

Full-or-part-time: 11h Laboratory classes: 3h Self study : 8h

Module 2: Determination of fibre orientation

Description:

The determination of orientation is described by means of:

- the operation of a sonic modulus measuring equipment.
- the operation of a polarised light microscope to determine birefringence as a measure of orientation.

Related activities:

Presentation of the theoretical contents by the lecturer with the active participation of the students. Resolution by the student of exercises, problems and practical cases. Personal study, work and analysis

Full-or-part-time: 21h Laboratory classes: 9h Self study : 12h



Mòdul 3: Determinació de la cristal·linitat de les fibres

Description:

Three equipment and methods for the determination of crystallinity are described:

- from density,
- by X-ray

- by DSC (differential scanning calorimetry).

Related activities:

Presentation of the theoretical contents by the lecturer with the active participation of the students. Resolution by the student of exercises, problems and practical cases. Personal study, work and analysis

Full-or-part-time: 21h

Laboratory classes: 9h Self study : 12h

Mòdul 4: Aplicació de l'anàlisi tèrmica a la determinació de microestructura de les fibres sintètiques

Description:

Thermal analysis allows other microstructure determinations to be made in addition to crystallinity:

- Thus, by means of differential scanning calorimetry the effective heat treatment temperature and its application to various types of fibres will be determined.

- Non-isothermal crystallisation of polymers and its application in the study of inorganic particle/polymer compatibility will also be studied.

- The thermogravimetric analysis equipment and what phenomena it can measure will be described.

- Thermomechanical analysis equipment shall be described and what phenomena it can measure.

Related activities:

Presentation of the theoretical contents by the lecturer with the active participation of the students. Resolution by the student of exercises, problems and practical cases. Personal study, work and analysis

Full-or-part-time: 24h

Laboratory classes: 9h Self study : 15h

Mòdul 5: Tècniques físico-químiques de caracterització de la microestructura

Description:

The physico-chemical techniques of critical dissolution time, differential solubility and iodine sorption are described and developed as physico-chemical techniques to study the microstructure of synthetic fibres and their variation with the variables of textile processing.

Related activities:

Presentation of the theoretical contents by the lecturer with the active participation of the students. Resolution by the student of exercises, problems and practical cases. Personal study, work and analysis

Full-or-part-time: 6h

Laboratory classes: 3h Self study : 3h



Mòdul 6: Mètodes espectroscòpics

Description:

The spectroscopic methods of UV-visible spectroscopy, atomic absorption spectroscopy, infrared spectroscopy and mass spectroscopy are described.

In all cases, the foundations of the technique (instrumentation, type of analysis) and some practical applications are studied.

Related activities:

Presentation of the theoretical contents by the lecturer with the active participation of the students. Resolution by the student of exercises, problems and practical cases. Personal study, work and analysis.

Full-or-part-time: 21h

Laboratory classes: 6h Self study : 15h

Mòdul 7: Mètodes cromatogràfics

Description:

Liquid chromatography, gas chromatography and GPC (Gel Permeation Chromatography). In all cases, the foundations of the technique (instrumentation, type of analysis) and some practical applications are studied.

Related activities:

Presentation of the theoretical contents by the lecturer with the active participation of the students. Resolution by the student of exercises, problems and practical cases. Persona.l study, work and analysis

Full-or-part-time: 21h Laboratory classes: 6h Self study : 15h

GRADING SYSTEM

 $\hat{a}\Box^{a}$ EV1: Written knowledge control tests: partial and final exam (each exam 25% of the final mark).

 $\hat{a}\Box^a$ EV2: Assessment of laboratory practices through written reports and oral presentations.

 $\hat{a}\Box^a$ EV3: Assessment of the resolution of practical cases and assignments by means of reports and oral presentations.

 $\hat{a} \Box^a$ EV4: Assessment of directed activities and exercises.

Weighting: EV1 = 50%; EV2= 20%; EV3 = 15%; EV4 = 15%.

For those students who fulfil the requirements and sit the re-evaluation exam, the grade of the re-evaluation exam will replace the grades of all the assessment acts that are face-to-face written tests (controls, mid-term and final exams) and the grades for practicals, assignments, projects and presentations obtained during the course will be maintained.

If the final mark after the re-evaluation is lower than 5.0, it will replace the initial mark only if it is higher. If the final mark after the re-evaluation is lower than 5.0, it will replace the initial mark only if it is higher. If the final mark after the reassessment is 5.0 or higher, the final mark for the course will be a pass mark of 5.0.

BIBLIOGRAPHY

Basic:

- Apunts de classe. Normes d'assaig ISO o UNE..

Complementary:

- Articles d'investigació que entregarà la professora.