



## Grado en Ingeniería de Materiales

**Departamento (Escuela)**

Departamento de Ciencia de Materiales (ETSI Caminos Canales y Puertos)

**Asignatura**

Soft Matter

ECTS	Tipo	Curso / Semestre	Idioma	Syllabus code	Subject Code
6	Compulsory	3 / 1	EN	04MI	45000129

Lecturers	Contact email	Office hours (Tutorials)
José Pérez Rigueiro	jperez@mater.upm.es	Friday 10:00-14:00
José Manuel Otón Sánchez	jm.oton@upm.es	Tuesday and Thursday 10:00-12:00

*El profesor que aparece en primer lugar es el coordinador de la asignatura*

**Criterio de evaluación****Continuum assessment.**

- Partial exam P1:(Biomimetics) ( $P1 \geq 3$ )
- Partial exam P2 (Liquid crystals) ( $P2 \geq 3$ )

To pass the subject the following condition must be fulfilled  $(P1+P2)/2 \geq 5$

**Regular exam.**

- Regular exam EO

To pass the subject the following condition must be fulfilled  $EO \geq 5$ .

**Extraordinary exam**

- Extraordinary exam EE

To pass the subject the following condition must be fulfilled  $EE \geq 5$ .

**Justification and objectives**

The main objective is to provide the student with the necessary knowledge in the field of soft matter, including biological materials, biomimetic systems and liquid crystals.

- Objective 1. Know the basic constituents of the biological materials and of the biomimetic systems, especially those made up of proteins.
- Objective 2. Know the foundations of molecular assembly and of the behaviour of the biological and biomimetic systems, in equilibrium and out of equilibrium.
- Objective 3. Know the foundations of the liquid crystals and their application to different devices.

**Prerequisites**

No prerequisites

**Previous knowledge of the student**

Mecánica de Materiales I y II; Biología

**Contents in coordination with other subjects**

Biología; Biomateriales I y II

**Generic competencies**

CG2,CG3, CG9, CG10, CG11

**Grado en Ingeniería de Materiales****Specific competencies**

CE3, CE6, CE7

**Bibliography**

Lecciones de Física Estadística. J. Pérez-Rigueiro. Ingebook ([www.ingebook.com](http://www.ingebook.com)). (2010)  
 Lecciones de Materiales Biológicos y Biomateriales. J. Pérez-Rigueiro. Ingebook ([www.ingebook.com](http://www.ingebook.com)) (2007)  
 An introduction to statistical thermodynamics. T.L. Hill. Dover Publications Inc. (1986)  
 Intermolecular and Surface forces. J.N. Israelachvili. Elsevier (2011)  
 Introduction to Soft Matter Physics. Hamley. Wiley (2000)  
 Liquid Crystals. I.C. Khoo. Wiley (Hoboken) (2007)  
 Introduction to liquid crystals: Chemistry and Physics. P.J. Collings and M. Hird. Taylor and Francis (2004)

**Subject contents and time distribution**

LM: Lesson at room, RP: Problems Resolution, LB: Laboratory,, TI: Individual Work, TG: Group Work, DB: Debate at Room, VI: Visits, EV: Exams, OT: Other procedures

<i>Ítem</i>	<i>Contents</i>	<i>Code</i>
1	Proteins. Composition. Structure. Molecular architecture of collagen	LM, RP
2	Introduction to complex systems. Self-cleaning surfaces and hydrophobic interaction. Order and disorder in complex systems	LM, RP
3	Statistical description of macromolecules. Diatomic and polyatomic molecules. Collective excitations	LM, RP
4	Self-assembly: Sickle cell anemia. Thermodynamics of self-assembly. Elastomers	LM, RP
5	Lipis. Composition. Self-assembly in micelles and bilayers	LM, RP
6	Adsorption on surfaces. Thermodynamics of adsorption. Biomineralization. Biocompatibility	LM, RP
7	Nonequilibrium thermodynamics. Membrane potential	LM, RP
8	Nonequilibrium kinetics. Reaction kinetics. Brownian movement. Fluctuation-dissipation theorem	LM, RP
9	Viscoelasticity. Experimental characterization. Microscopic origin	LM, RP
10	Partial exam P1	EV
11	Liquid crystals. Types of liquid crystals. Physical properties	LM, RP
12	Electrooptical properties. Molecular reorientation. Light polarization. Circular and linear retarders	LM, RP
13	Associated technology. Liquid crystals cells. Processing. Electrooptical response. Dynamic response	LM, RP
14	Diplays. Addressing. Multiplexing. Optical switches. Tunable lenses and prisms	LM, RP
15	Partial exam P2	EV