

**COURSE DATA****Data Subject**

Code	44422
Name	Molecular nanomaterials: Methods of preparation, properties and applications
Cycle	Master's degree
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
2208 - M.D. in Molecular Nanoscience and Nanotechnology	Faculty of Chemistry	1	First term

Subject-matter

Degree	Subject-matter	Character
2208 - M.D. in Molecular Nanoscience and Nanotechnology	6 - Molecular nanomaterials: Methods of preparation, properties and applications	Obligatory

Coordination

Name	Department
CORONADO MIRALLES, EUGENIO	320 - Inorganic Chemistry

SUMMARY

We intend to provide the students with the necessary knowledge on the basic aspects of Nanoscience alongside with its implications in the design and development of new molecular materials with unconventional properties.

PREVIOUS KNOWLEDGE**Relationship to other subjects of the same degree**



There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There are no specified enrollment restrictions with other subjects of the curriculum.

OUTCOMES

2208 - M.D. in Molecular Nanoscience and Nanotechnology

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- To possess the necessary knowledge and abilities to continue with future studies in the PhD program in Nanoscience and Nanotechnology.
- For students from field of knowledge (e.g. chemistry) to be able to scientifically communicate and interact with colleagues from another field (e.g. physics) in the resolution of problems laid out by the Molecular Nanoscience and Nanotechnology.
- To know the methodological approaches used in Nanoscience.
- To acquire supramolecular chemistry conceptual concepts necessary for the design of new nanomaterials and nanostructures.
- To know the state of the art in molecular nanomaterials with optical, electric and magnetic properties.
- To assess the relationships and differences between the materials macroscopic properties and those of unimolecular systems and nanomaterials.
- To know the main molecular nanomaterials technological applications and to be able to put them in the Material Science general context.
- To know the main applications of nanoparticles and nanostructured materials obtained or functionalised using a molecular approach- in magnetism, molecular electronics and biomedicine.

LEARNING OUTCOMES



We intend to provide the students with the necessary knowledge on the basic aspects of Nanoscience alongside with its implications in the design and development of new molecular materials with unconventional properties.

DESCRIPTION OF CONTENTS

1.

Molecular Nanomaterials: Preparation methods, properties and applications.

1. Molecular Magnetic Materials: Design, synthesis, characterization and applications of i) molecular nanomagnets; ii) magnetic nanoparticles obtained by a molecular approach; iii) switchable magnetic molecules iv) multifunctional molecular magnetic multilayers and magnetic materials.
2. Materials with optical properties: Liquid crystals, materials for nonlinear optics, optical limiters, etc.; supramolecular types of organizations and applications.
3. Materials with electrical properties: molecular conductors and superconductors: electronic structures, organization on surfaces and interfaces, properties and applications (chemical sensors, field effect transistors (FETs), etc.).
4. Conducting polymers: Properties and applications.
5. Carbon nanoforms: Structures, properties, methods of production and organization and applications.
6. 2D crystals.
7. Applications of nanomaterials in biomedicine (contrast agents, drug delivery, teragnostic systems)

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Seminars	9,00	100
Tutorials	8,00	100
Other activities	2,00	100
Preparation of evaluation activities	80,00	0
Preparing lectures	21,00	0
TOTAL	150,00	

TEACHING METHODOLOGY

- Theory classes, participatory lectures
- Articles discussion.
- Chaired debate or discussion.
- Practical cases or seminar problems discussion.
- Seminars.
- Problems.
- Laboratory practices and demonstracions and visit to installations.



- Experts conferences.
- Attendance to courses, conferences and round tables.

EVALUATION

Written exam about the subject basic contents	70-90%
Attendance and active participation in seminars.	0-10%
Questions answering	10-20%

REFERENCES

Basic

- G.A. Ozin, A.C. Arsenault: Nanochemistry. The Royal Society of Chemistry, 2005.
- H.S. Nalwa Ed.: Handbook of Advanced Electronic and Photonic Materials and Devices, Academic Press, 2001.
- D.M. Guldi, N. Martín Eds.: Fullerenes: From Synthesis to Optoelectronic Properties. Kluwer Academic Press, Dordrecht, Netherland, 2002.
- P.J. Collings, Liquid Crystals: Nature's delicate order of Matter. 2^a Ed., Princeton University Press, 2002.
- M.C. Petty, M.R. Bryce, D. Bloor, Eds.: Introduction to Molecular Electronics, Oxford University Press, NY, 1995.
- Ulman, An Introduction to Ultrathin Organic Films: from Langmuir-Blodgett to Self-Assembly, Academic Press, San Diego, 1991
- Supramolecular Chemistry: From Molecules to Nanomaterials, ed. P. Gale and J. Steed, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2012
- Nanomedicine, in Nanotechnology, ed. H. Fuchs, M. Grätzel, H. Krug, G.
- Schmid, V. Vogel and R. Waser, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2010, vol. 5

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council



1. 1. Contenido /Contingut/ Content
Contents initially included in the teaching guide are maintained.
2. Volum de treball i planificació temporal de la docència 2. Volumen de trabajo y planificación temporal de la docencia 2. Workload and teaching time planning
3. Metodologia docente / Metodología docente/ Teaching Methodology
<p>The workload of different teaching activities (theory classes, seminars and tutorials) is maintained.</p> <p>The theory classes, which should have been taught intensively in Valencia during two weeks, are being recorded as a slide show with narration. This material will be available to students in a e-learning platform (Master Intranet, Moodle (Aula Virtual) or MSTeams) two weeks before the online lessons. Students will be informed how to access these classes.</p> <p>All these lessons have a seminar part, which is planned to be given online by each professor using the common videoconference programs available in the participating universities (Blackboard collaborate, Teams, Zoom, etc.). This seminar part includes solving practical problems, questions and student doubts related to the subject. The attendance to these online videoconferences will be compulsory for all master students and will be recorded and uploaded in the e-learning platform. This part will be tentatively scheduled in the same period as in-person lectures.</p> <p>Finally, person to person tutorials to answer questions / doubts will be available as in previous years through telephone, E-mail and, additionally, through chats in the e-learning platform.</p>
4. Avaluació/Evaluación/ Evaluation
Given that this exam will be carried out by small groups of students in each university (maximum of 14 students in the University of Valencia) and they have been delayed to July, it will be attempted to do it "in person". If the face-to-face examination would not be possible, it will be carried out on-line using the e-learning platform videoconference.



‘Questions answering’ and ‘Attendance and active participation in seminars’ will be evaluated during the online seminars.

Students will be informed with at least 10 days in advance if the exams will be done in-person or on-line.

5. Bibliografia/Bibliografía/Bibliography

Some of the recommended bibliography is available online. In case a student wants more detailed information on a specific topic, professors will provide it through scientific articles (to which the Universities are subscribed or published with open-access), doctoral PhD theses in public repositories, etc.