VNIVERSITAT DE VALÈNCIA

# Course Guide
# 44422 Molecular nanomaterials: Methods of preparation, properties and applications

## COURSE DATA

**Data Subject**

| | |
|---|---|
| **Código** | 44422 |
| **Name** | Molecular nanomaterials: Methods of preparation, properties and applications |
| **Cycle** | Master's degree |
| **ECTS Credits** | 6.0 |
| **Curso académico** | 2017 - 2018 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 2208 - M.U. en Nanociencia y Nanotecnolog²a Molecular | FACULTY OF CHEMISTRY | 1 | First term |

**Subject-matter**

| Degree | Subject-matter | Character |
|---|---|---|
| 2208 - M.U. en Nanociencia y Nanotecnolog²a Molecular | 6 - Molecular nanomaterials: Methods of preparation, properties and applications | Obligatory |

**Coordination**

| Name | Department |
|---|---|
| CORONADO MIRALLES, EUGENIO | 320 - QUđMICA INORGĆNICA |

## 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.U. en Nanociencia y Nanotecnología Molecular

- Students can apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
- Students are able to integrate knowledge and handle the complexity of formulating judgments based on information that, while being incomplete or limited, includes reflection on social and ethical responsibilities linked to the application of their knowledge and judgments.
- That student can communicate their conclusions and the knowledge and rationale underpinning these conclusions, in a clear manner, to specialized and unspecialized audiences.
- Students have the learning skills that will allow them to continue studying in a way that will be largely self-directed or autonomous.
- Students have the knowledge and understanding that provide a basis or an opportunity for originality in developing and/or applying ideas, often within a research context.
- 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

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|---|---|
| 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 Avanced 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: Natuers delicate of Mater. 2ª Ed., Princenton 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