Universitat Autònoma de Barcelona

2022/2023

Nanotechnology and Society

Code: 103290
ECTS Credits: 6

Degree	Type	Year	Semester
2501922 Nanoscience and Nanotechnology	OT	4	1
2504235 Science, Technology and Humanities	OT	4	1

Contact

Name: Eva Maria Pellicer Vila
Email: eva.pellicer@uab.cat

Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Jose Lopez Barbera Martin

Prerequisites

Not required.

Objectives and Contextualisation

This subject provides students with a general overview of nanotechnology, beyond the scientific content developed during the degree. The main goal is to offer a cross-training which will allow students to identify what are the fields of application of nanotechnology, its impact on society, and what will our society look like in the near future. This will enable students to uncover areas in which a nanotechnologist can have a place but have so far been unknown. The subject is organized into five units: 1) Nanotechnology in perspective. 2) Scientific development of nanotechnology. Large areas: future challenges. 3) Technological development of nanotechnology. Patents 4) Economic development of nanotechnology. Analysis of indicators. 5) Nanotechnology and society. The idea is to explore beyond the science itself so that, after the multiple possibilities nanotechnology fits into society and labour market are disclosed, students become aware that greatest potential for labour market integration happens when the scientific training acquired during the degree couples to transferable skills.

Competences

Nanoscience and Nanotechnology

- Adapt to new situations.
- Apply ethical principles and legislative standards to the field of nanoscience and nanotechnology.
- Be ethically committed.
- Communicate clearly in English.
- Communicate orally and in writing in one's own language.
- Demonstrate knowledge of legislation on intellectual property in the field of knowledge and application of nanoscience and nanotechnology.

- Demonstrate knowledge of the concepts, principles, theories and fundamental facts related with nanoscience and nanotechnology.
- Lead and coordinate work groups.
- Learn autonomously.
- Manage the organisation and planning of tasks.
- Obtain, manage, analyse, synthesise and present information, including the use of digital and computerised media.
- Perform correct evaluations of the environmental and socioeconomic impact of chemicals and nanomaterials.
- Reason in a critical manner
- Recognise the terms used in the fields of physics, chemistry, biology, nanoscience and nanotechnology in the English language and use English effectively in writing and orally in all areas of work.
- Resolve problems and make decisions.
- Show initiative and an enterprising spirit.
- Show sensitivity for environmental issues.
- Work correctly with the formulas, chemical equations and magnitudes used in chemistry.

Learning Outcomes

1. Adapt to new situations.
2. Apply the necessary ethical principles for the experimental and commercial validation of new products derived from nanotechnology that require animal or human experimentation.
3. Be ethically committed.
4. Communicate clearly in English.
5. Communicate orally and in writing in one's own language.
6. Describe from an interdisciplinary and transversal point of view the impact of nanoscience and nanotechnology on society
7. Describe the fundamental aspects of the management and protection of knowledge of scientific and technical results.
8. Describe the legal procedures and options for the protection of marketable results.
9. Describe the main fields of application of nanoscience and nanotechnology and their prospects.
10. Describe the main physical and chemical properties dependent on the size of materials.
11. Draft reports on the subject in English.
12. Identify and know the legislative standards involved in the commercialisation of new products derived from nanotechnology, and for the experimental validation of the same.
13. Identify the main economic, environmental, social and ethical implications and prospects of nanoscience and nanotechnology.
14. Interpret texts and bibliographies in English on each of the techniques, methodologies, tools and instruments used in the subject.
15. Lead and coordinate work groups.
16. Learn autonomously.
17. Manage the organisation and planning of tasks.
18. Obtain, manage, analyse, synthesise and present information, including the use of digital and computerised media.
19. Present brief reports on the subject in English.
20. Reason in a critical manner
21. Recognise the risks to the environment associated to the manipulation of products derived from nanotechnology.
22. Recognise the terms used in topics related to nanoscience, nanotechnology and society.
23. Resolve problems and make decisions.
24. Show initiative and an enterprising spirit.
25. Show sensitivity for environmental issues.
26. Work correctly with the formulas, chemical equations and magnitudes used in chemistry.

Content

1. Nanotechnology in perspective

Why nanotechnology has grown so rapidly?

Role of policymakers. Promoting technology transfer from universities and research institutes to private sector.

The NNI in USA and the Communications of the Commission of the European Communities. National initiatives. Nanotechnology in Spain and Catalonia.

2030 Challenge: Knowledge-based economy.

Nanotechnology: One of the 5 key enabling technologies for society and economy.

2. Scientific development of nanotechnology. Large areas: future challenges

Scientific basis of nanotechnology: scientific publications and citations.

Manufacturing, characterization and tools; Importance of instrumentation.

Advanced materials: next-generation materials and devices.

Medicine and biotechnology: nanotechnology to revolutionize medicine.

Electronics and microsystems.

Energy and environment: nanotechnology to overcome the energy problem, produce clean water, etc.

3. Technological development of nanotechnology. Patents

Industrial innovation, from knowledge to technology.

Gartner's Magic Quadrant and hype cycle.

Problems in industrial scale-up. Instrumentation and quality control.

Scientific production and intellectual protection in nanotechnology.

Patents. Conditions of patentability.

Creation of EBTs.

4. Economic growth of nanotechnology. Analysis of indicators

Commercialization of nanotechnology; market share.

The global nanotech race: public investment and private investment.

Venture capital investment in high-tech research.

Economic impact assessment.

5. Nanotechnology and society

Public health, safety and environmental protection and consumers.

Regulations: Nanomaterials and REACH regulation in nanotechnology. EU legislation.

Potentials risks of nanotechnology. FDA and EMEA.

Risk management in nanotechnology. Securing nanoproducts.

Investment in human resources: education, training and employment opportunities.

Integration of the social dimension: public concern and science communication. Observatory on nanotechnologies. Ethics and nanotechnology.

The persuasive "nano" prefix.

Perspective and gender dimension in science, and nanoscience in particular.

Methodology

Onsite teaching will be delivered, unless health authorities impose virtual teaching. In this case, the TEAMS tool will be used.

Lectures

The teacher will introduce and develop the theoretical contents of the subject using ppt. Supporting material will be delivered to students.

Classroom debates (forums) and exercises

Debates and exercises (in the broadest sense of the word) will serve to consolidate and see how the knowledge acquired during theory classes is put into practice. They will be intercalated with the theory classes to reinforce specific aspects or at the end the thematic units. The debates will be carried out under the guidance of the teacher and with the proactive participation of the students.

Seminars

Seminars will be given by renowned experts in specific areas of nanoscience and nanotechnology to tackle social aspects of nanotechnology. Students are encouraged to actively participate in these sessions, so that they can address the speaker any question they consider appropriate and relevant, in order to trigger a forum around the nano world, ranging from its applications to social and ethical implications.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Bibliographic search	10	0.4	16, 24, 17, 14, 3, 18, 20, 22
In-class exercises and case studies	12	0.48	1, 16, 5, 6, 9, 13, 18, 20, 23, 26
Lectures	30	1.2	6, 9, 8, 13
Seminars	20	0.8	1, 2, 16, 4, 24, 19, 17, 14, 15, 3, 18, 20, 22, 11, 26
Type: Supervised			
Mentoring	18	0.72	2, 24, 6, 9, 17, 12, 13, 3, 25, 20, 21, 22
Type: Autonomous			

Problem solving	10	0.4	1, 16, 4, 24, 15, 3, 25, 18, 20, 23, 26
Reading articles	5	0.2	1, 16, 14, 3, 18, 20
Self-study	25	1	1, 16, 4, 24, 14, 15, 3, 18, 20, 22, 11, 26

Assessment

Essay: the student will have to demonstrate critical thinking regarding the contents of the reading material (10% of the mark).

Oral presentations: they represent 65% of the final mark. Two oral presentations are planned: an individual and a group (2-3 students) presentations. For each, the oral presentation will be followed by a discussion with the classmates. Oral presentations are compulsory, as well as attendance at the presentations delivered by the other students. The technical and formal quality of the presentation as well as the answers given during the discussion phase will be considered. There will be two qualifications, one corresponding to the individual presentation (35%) and another to the joint presentation (30%).

Exam covering the theory content of the subject and the aspects addressed during the practical sessions and seminars. It represents 25% of the final mark and it is mandatory, otherwise the subject will be considered non-assessable.

Attendance at seminars delivered by experts in the field is also mandatory.

The proactive attitude in the classroom will be taken into account for the final grade of the subject.

Re-assessment for this subject requires the student must previously have done a minimum of two-thirds of the course-assessment items.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Essay on manuscript / newspaper article	10%	2	0.08	4, 13, 14, 20, 11
Exam	25%	1	0.04	2, 6, 7, 9, 8, 10, 12, 13, 21, 22
Individual oral presentation	30%	8	0.32	1, 2, 16, 4, 5, 24, 6, 7, 9, 8, 10, 19, 17, 12, 13, 14, 15, 3, 25, 18, 20, 21, 22, 11, 23, 26
Joint oral presentation	35%	9	0.36	1, 2, 16, 4, 24, 6, 9, 10, 19, 17, 13, 14, 15, 25, 18, 20, 22, 11, 26

Bibliography

There is not a dedicated textbook. Relevant works in the field will be indicated in the ppt slides and lecture notes given by the teacher.

Software

Not applicable.