66105 - 6. Examples of Nanodevice Fabrication and Applications

Course 2013 - 2014

Curso: 1, Semestre: 0, Créditos: 8.0

Basic information

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Recommendations to attend this course

The “Nanodevice Fabrication and Application” module is obligatory and counts for 8 ECTS credits or 200 student work hours. Of these 8 credits, 2 are for theory and 6 correspond to laboratory practicals. The course is given in the second term of the academic year. As with the other modules in this Master's, this module is taught and assessed completely in English.

The objective of this module is that the students can make their own nano- or microdevices, experiencing the potential applications and becoming familiar with the practical and real application of the material studied in the previous modules.

This module is mainly practical and the students will make and characterise their own devices, evaluating the practical

applications of these. The theory classes will focus on explaining the theory upon which the devices the students will make in the laboratory is based. The students will have access to sophisticated production and characterization equipment.

As the whole course is taught in English, students need to have an upper-intermediate level in the language: minimum level B1 in the European Common Framework Language Reference, but preferably level B2. Level B1 is reached when the student is able to understand the main points of clear, standard-language texts when covering known matters - whether in terms of work, study or leisure; when able to cope in most situations which the student encounters during a trip to places where the language is spoken; when able to write simple, coherent texts on familiar topics or those in which the student has an interest; and when able to describe experiences, happenings, wishes and ambitions as well as briefly justify opinions or explain plans. B2 is achieved when the student is able to understand the main ideas of complex texts that deal with both specific and abstract topics, even if these are technical - though within the field of specialisation; when able to communicate with native speakers with the degree of fluency and ease such that the communication takes place without effort on either side; and when able to write clear, detailed texts on diverse subjects as well as defend a point of view on general topics - giving the pros and cons of the different options.

Additional information about this master (grants, events, etc.) can be found on the web site: www.unizar.es/nanomat

Course Schedule and Deadlines

Dates and key points for the subject

This module is taught in the second term, following on from module 5, and is expected to start at the beginning of April and last some five weeks.

The course is given in the afternoon and the calendar for classes and exam dates will be published prior to the beginning of each academic year in the web site of the Faculty of Science (https://ciencias.unizar.es/web/horarios.do).

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Learning outcomes that define this course

The student, in order to pass the course, will have to show her/his competence in the following skills:

1:
Be able to identify and, with rigour, and describe some of the recent specific developments in research that have led to nanotech applications.

2:
Identify opportunities to apply theory and knowledge of the phenomena taking place at the nanoscale for the making of devices and specific applications.

3:
Assess the true difficulties that come with the practical pursuit of an idea or concept.

Introduction

Brief presentation of the course

In this module, specific examples are given in detail of nanotech applications, explaining the basis (physical or chemical phenomenon that gives rise to the development in question), the approach to the

problem, the phases of development, the difficulties encountered and the end result.

The following examples are proposed for the 2013-14 course: Biosensors. Drug Delivery. Microsensors. Organic light emitting diodes (OLEDs). Production of electronic devices using nanolithography. Microcantilevers. Microreactors.

Competences

General aims of the course

The expected results of the course respond to the following general aims

The subject and its expected results respond to the following general planning and objectives:

In this module, the students will apply the theoretical knowledge acquired in the previous modules in the Master's (production and characterization of nanostructured materials) to real problems, which will lead to them producing nanodevices and directly observing their properties. Thus, they will become aware of the potential applications of Nanotechnology in a more natural way for fields as diverse as molecular electronics and nano-biomedicine.

Context/Importance of the course for the master degree

Once the students have a solid theoretical base and have learnt the general ways to prepare nanostructured materials and characterise them, this module is a step forward. This knowledge is applied to the solving of real problems and they get to create their own devices. This will make them more aware, on the one hand, of the potential applications of the discipline they are studying and, on the other, will also make them aware of the real difficulties coming with the application and market possibilities of these devices.

After completing the course, the student will be competent in the following skills:

1:
Understand and successfully prepare nanodevices.

2:
Design and create nanodevices, assessing real difficulties in their production and in the requirements for these to reach the marketplace.

Relevance of the skills acquired in the course

The results of the learning process for this subject are important because:

This module involves the application of the theoretical knowledge and the manual skills acquired by the student to the design and production of nanodevices that may have real, significant applications in the current market. Furthermore, we trust that this subject - in which the students make nanotech devices - will contribute to motivating and encouraging them to face new challenges and to awaken new interests.

Evaluation

Assessment tasks

The student will prove that he/she has achieved the expected learning results by means of the following assessment tasks:

1:

ONGOING ASSESSMENT

1. For students choosing ongoing assessment:

a.- The teachers for the practicals will assess the abilities and skills of the students in the laboratory (20%). They will score between 1 and 10 on basic aspects such as instrument handling skills, accuracy when performing experiments, attention to detail, ability to resolve unforeseen problems or difficulties that may arise, etc.

b.- Answering questions posed by the practical teachers which include questions on the theoretical bases on which the practicals are based as well as the analysis and interpretation of the results obtained in the laboratory (40%). The teachers of the practical credits for the subject will score from 1 to 10 the Q&As and reports handed in by the students on their laboratory results and the interpretation of these. Special attention will be paid to checking that students have acquired the necessary abilities from these practical sessions, i.e. handling of nanomaterial production techniques, recognition of experimental difficulties in these processes, problem, risk and difficulty evaluation, interpretation of results obtained, professional presentation of laboratory-acquired results and written communication ability with specific language appropriate to the topic under consideration.

c.- Students will create a highly detailed report (introduction to where the state of art of the corresponding topic lies, objectives, results, debate, conclusions and bibliography) on one of the practicals in this module (40%). Special attention will be paid to checking the students have acquired the necessary abilities from these practical sessions, i.e. the ability to design and produce a nanotech device. Likewise, the student's written communication skills, use of language with appropriate scientific rigour, quality and report presentation will also be assessed.

A minimum mark of 4 out of 10 is needed for each of the three parts of the assessment to pass the subject. In any case, the average over the three sections must be at least 5 out of 10 to pass the subject.

2:

HYBRID AND OTHER SITTINGS

For hybrid students coming to other sittings or wishing to increase their mark, the assessment consists of:

Firstly, there will be a multiple choice test which must be passed before going into the laboratory. Here the judgment is on whether or not the student is ready to respect the laboratory safety norms and if the student is able to manage the instruments involved in the practical test. This is an elimination test which can only be passed with a score of 8 out of 10. This first test counts for 5% of the total for this test. Once the test is passed, the student begins the laboratory exam. This consists of an experiment in which the student must show the capability to plan the necessary experiments given the objectives to be achieved. These experiments must be performed adequately, correctly using the corresponding instruments (an expert will at all times be supervising and will halt the exam if this person sees that the student is endangering the equipment used or their own safety). This part counts for 65% of the mark in this test. Lastly, the student must interpret the data obtained and write a report in which the results obtained are analyzed and the main conclusions given. A score of between 1 and 10 will be given for the scientific quality of the report presented and the student's communication skills. This report is worth 30% of the total mark for this test.

Activities and resources

Course methodology

The learning process that has been designed for this course is based on the following activities:

The learning process created for this subject is based on:

Following a talk by the lecturer in charge of supervising the production of each nanodevice (participatory master class), the students will have the basic ideas necessary to successfully make the nanodevice and determine its properties. This will then be done in the laboratory under the supervision of the staff.

Outline of the Programme

The programme offered to the students to help them achieve the learning results includes the following activities :

1:
Each device to be made will be described in participatory master classes by the lecturer responsible, who will later tutor the students in the production process.

2:
Each device to be made will be described in participatory master classes by the lecturer responsible, who will later tutor the students in the production process.

Course planning

Calendar of actual sessions and presentation of works

This calendar will be published at the beginning of each academic year in the web site of the Faculty of Science (https://ciencias.unizar.es/web/horarios.do). All classes will be in the afternoon.

Bibliographic references of the recommended readings