CÓDE	NAME OF MODULE	TYPE
	EXPERIMENTAL TECHNIQUES I: STRUCTURAL CHARACTERIZATION	M

M = mandatory
E = elective

3.3.1. Learning goals of the module.

(List the specific learning goals that the current module should provide to the student; goals can focus on content, skills, or attitudes.)

THE GOAL OF THIS COURSE IS TO APPROXIMATE THE STUDENT TO THE THEORETICAL AND EXPERIMENTAL FOUNDINGS OF THE STRUCTURAL CHARACTERIZATION TECHNIQUES IN MATERIALS, FOCUSING IN THE ONES THAT ARE MORE USED IN THE CHARACTERIZATION OF NANOSTRUCTURED MATERIALS.
SURFACE STRUCTURE CHARACTERIZING TECHNIQUES (SCANNING MICROSCOPIES, TUNNELING MICROSCOPY, ATOMIC FORCE MICROSCOPY) AS WELL AS BULK STRUCTURE TECHNIQUES (TRANSMISSION ELECTRONIC MICROSCOPY, X-RAY DIFFRACTION, NEUTRON DIFFRACTION) ARE INTRODUCED.

3.3.2. Methodology: learning activities and credit value of the module (ECTS).

3.3.2.1. Learning activities.

(Time required to teach the module; links to other modules included in the MSc Program and suggested chronological sequence with the latter)

THIS MODULE IS PLANNED FOR A HALF ACADEMIC YEAR WITH 3 ECTS DIVIDED IN 20 THEORETICAL LECTURE HOURS, 10 PRACTICAL HOURS (EXERCICES AND LABORATORY) AND 45 PERSONAL WORK HOURS. IN THESE LAST HOURS THE STUDENT WILL HAVE TO DO SOME BIBLIOGRAPHIC WORK WITH THE CORRESPONDING EXPOSITION ABOUT SOME PART OF THE COURSE.
THIS MANDATORY MATTER MAKES AN OVERVIEW FROM BOTH VIEWPOINTS, BASIC AND INSTRUMENTAL, OF THE MICROSCOPY AND DIFFRACTION TECHNIQUES. WE MUST POINT OUT ITS FOUNDAMENTAL CHARACTER IN THE MASTER. OTHER MODULES MANDATORY ("INTRODUCTION TO MATERIALS SCIENCE", "FUNDAMENTALS OF SOLID STATE", "SOFT MATTER AND NANOSTRUCTURED MATERIALS", "FUNDAMENTALS OF NANOSCALE CHARACTERIZATION") AND ELECTIVE (WHERE SOME ASPECTS EXPEDED IN THIS MODULE ARE MADE DEEPER) ARE STRAIGHTFORWARDLY RELATED TO THIS MATTER.

3.3.2.2. ECTS credit value (and time)

1 ECTS credit = 25 hours UPV/EHU

TYPE OF LECTURE(1)	Theory		Practice							Evaluation	
	M(2)	S	PA	PL	PO	TA	TAI	PCL	PCC	Periodic Grading	Final Grading
Classroom lectures	20	4		3							3
Personal work (3)	15	25		5							
TOTAL	35	29		8							3

(1) M (standard lecture); S (seminar); PA (practical exercises in classroom); PL (practical exercises in laboratory); PO (practical exercises with computers); TA (non-industrial workshops); TAI (industrial workshops); PCL (clinical practice); PCC (field practice); the acronyms are taken from the Spanish wording.

(2) M = maximum allowed is 60% of the full classroom lectures .

(3) Personal work = time that the student would use to prepare and develop individual and group assignments.

3.3.2.3. Module Program.

(Lectures)

Lecture 1	INTRODUCTION: MEASURING AT THE NANOSCALE
Lecture 2	THE LIMITS OF OPTICAL MICROSCOPY. CONFOCAL MICROSCOPY
Lecture 3	ELECTRON MICROSCOPIES. TRANSMISSION ELECTRON MICROSCOPY, SCANNING ELECTRON MICROSCOPY
Lecture 4	SCANNING PROBE MICROSCOPY: PRINCIPLES OF OPERATION. TUNNELLING MICROSCOPY,
Lecture 5	ATOMIC FORCE MICROSCOPY. BASIC PRINCIPLES AND MULTIMODE OPERATION.
Lecture 6	DIFFRACTION TECHNIQUES: INTRODUCTION TO DIFFRACTION,
Lecture 7	X-RAY DIFFRACTION (WIDE ANGLE AND SMALL ANGLE TECHNIQUES)
Lecture 8	PARTICLE DIFFRACTION (NEUTRONS, ELECTRONS, ATOMS)

3.3.2.4. Bibliography.

(Basic and specialized bibliographies, journal references, internet addresses, etc.)

1- ROBERT H WEBB, CONFOCAL OPTICAL MICROSCOPY, REP. PROG. PHYS. 59 (1996) 427–471
2.- E. MEYER, H. J. HUG AND R. BENNEWITZ "SCANNING PROBE MICROSCOPY: THE LAB ON A TIP", SPRINGER VERLAG.
3.- THE NANOTECHNOLOGY MULTIMEDIA ENCYCLOPEDIC COURSES, "EXPLORING NANOTECHNOLOGY" NANOPOLIS.
4.- SCANNING PROBE MICROSCOPY. THE LAB ON A TIP. E. MEYER, H.J. HUG, R. BENNEWITZ. SPRINGER
5.- J. P. EBERHART "STRUCTURAL AND CHEMICAL ANALISYS OF MATERIALS: X-RAY, ELECTRON AND NEUTRON DIFFRACTION - X-RAY, ELECTRON AND ION SPECTROMETRY – ELECTRON MICROSCOPY", WILEY, 1991
6.- "INTERNATIONAL TABLES FOR CRYSTALLOGRAPHY", KLUWER, 1995.
7.- H. P. KLUG AND L. E. ALEXANDER "X-RAY DIFFRACTION PROCEDURES FOR POLYCRYSTALLINE AND AMORPHOUS MATERIALS", WILEY, 1974.

3.3.3. Criteria and methods for evaluation and grading

(Analysis of the methodology that will be used to evaluate the learning process of the student)

As it is a module of fundamental and basic character for the development of the master, it will be necessary to evaluate the acquired knowledge by means of an examination which will correspond to a 70% of the final qualification. The resting 30% will be marked by the work developed in the classroom and laboratories.

3.3.4. Learning resources

The student will have free access to the libraries of the Facultad de Química of the UPV/EHU, the Centro de Física de Materiales (Centro Mixto CSIC-UPV/EHU) and to the existing computer resources.
When existing in the neighbouring, we will visit the laboratories disposing of the described experimental techniques
ACCESS TO LECTURE VIEWGRAPH PDF'S AND SUPPLEMENTARY MATERIAL AT THE INTRANET AREA OF THE INTERNET WEB SITE: http://www.mscnano.eu/Intranet/ETI

3.3.5. Language and number of groups attending the module

1	NUMBER OF GROUPS
x	LANGUAGE: ENGLISH

3.3.6. Fields of science and technology to which the module is related

CODE	FIELD
	PHYSICS OF CONDENSED MATTER
	APPLIED PHYSICS

3.3.7. Department in charge of the Program

CODE	DEPARTMENT [1]
	DEPARTMENT OF MATERIALS PHYSICS

3.3.8. Teachers in charge of the module

DNI	Teacher UPV/EHU	Number of credits
15918091K	Angel Alegría Loinaz	1.5
15919409M	Juan José del Val Altunas	1.5

DNI	Teacher other institutions	Number of credits