| CÓDE | NAME OF MODULE | TYPE |
|---|---|---|
| | MATHEMATICAL METHODS FOR NANOSCIENCE | 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 MODULE IS TO PROVIDE THE STUDENTS WITH THE REQUIRED FUNDAMENTAL MATHEMATICAL METHODS FOR THE THEORETICAL DEVELOPMENTS OF THE DEGREE.

### 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)*

The program will consist of lectures up to 46 hours which are to be distributed among theoretical ones, seminars and problems. The instrumental character of the subject requires the dedication of a considerable number of seminars and practical exercises in order to apply the theoretical mathematical methods to real problems.

Since this module is aimed to provide the student with basic knowledge, the subject will be held in the first term (four month period) of the first year of the degree.

**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 | 15 | 10 | 5 | | | | | | | | 3 |
| Personal work [3] | 30 | 20 | 10 | | | | | | | | |
| **TOTAL** | 45 | 30 | 15 | | | | | | | | 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 | THEORY OF FUNCTIONS OF A COMPLEX VARIABLE |
| Lecture 2 | INTEGRATION IN THE COMPLEX PLANE |
| Lecture 3 | FUNCTIONAL ANALYSIS. HILBERT SPACES |
| Lecture 4 | THEORY OF LINEAR OPERATORS. APPLICATIONS TO DIFFERENTIAL EQUATIONS. |
| Lecture 5 | GROUP THEORY |

### 3.3.2.4. Bibliography.

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

**COMPLEX ANALYSIS: FOR MATHEMATICS AND ENGINEERING, FIFTH EDITION, 2006 JOHN H. MATHEWS AND RUSSELL W. HOWELL**

**GRADUATE MATHEMATICAL PHYSICS. KELLY, JAMES J.**

ANALISIS REAL Y COMPLEJO. W. RUDIN. MC GRAW HILL.

ADVANCED ENGINEERING MATHEMATICS. ERWING KREYZIG. JOHN WILEY&SONS

MATHEMATHICS METHODS FOR PHYSICS&ENGINEERING RILEY ET AL. CAMBRIDGE

GROUP THEORY IN PHYSICS J.F. CORNWELL

### 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)*

The evaluation of the knowledge of the fundamentals obtained by the student will be deduced by means of individual tasks which might include the resolution of practical problems and their presentation as a short lecture

### 3.3.4. Learning resources

The student should be given open access to the bibliographical material of the libraries of the Faculty of Chemistry of the UPV/EHU, the Unit of Physics of Materials and also to that of the Donostia International Physics Center. Moreover, within the aim of performing computer practices and tasks the computer science resources of the Donostia International Physics Center will be also available.

### 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 |
| | |
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### 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 |
|---|---|---|
| 14.886.977 C | Rivacoba Ochoa, Alberto | 1.5 |
| 15.976.311 M | Alvarez González, Fernando | 1.5 |
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| DNI | Teacher other institutions | Number of credits |
|---|---|---|
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