Bachelor´s Degree in Chemistry

Subject Guide

1. Information about the subject

SUBJECT	General Physics II		**CODE**	GQUIMI01-1-004
EDUCATIONAL OFFER	Bachelor´s Degree in Chemistry	**CENTER**	Facultad de Química	
TYPE	Core	**N° TOTAL CREDITS**	6.0	
PERIOD	Second Semester	**LANGUAGE**	Spanish English	
COORDINATORS/ES		**EMAIL**		
SANCHEZ RODRIGUEZ MARIA LUISA		mlsr@uniovi.es		
LECTURERS		**EMAIL**		
Folgueras Gómez Santiago		folguerassantiago@uniovi.es		
SANCHEZ RODRIGUEZ MARIA LUISA		mlsr@uniovi.es	(English Group)	
Iglesias Pastrana Roberto Luis		roberto@uniovi.es	(English Group)	

2. Context

1. Course identification

NAME	**FÍSICA GENERAL II**	CODE	

DEGREE	**GRADO EN QUÍMICA**	FACULTY	**FACULTAD DE QUÍMICA**
TYPE	**Obligatoria**	TOTAL AMOUNT OF CREDITS	**6.0**
PERIOD	**1st year, 2nd Semester**	LANGUAGE	**English**
LECTURERS		TELEPHONE /EMAIL	PLACE
Maria Luisa Sánchez Rodríguez **Roberto Iglesias Pastrana**		**mlsr@uniovi.es** **roberto@uniovi.es**	**Departamento de Física, Facultad de Ciencias, Despacho 17 (M.L.Sanchez)** **Despacho 22 (R.Iglesias)**

2. Context

Physics II is a subject contained in the Basic Foundational Module, as part of the first year Physics Curriculum. It is included in the second semester of the first year. In the present curriculum it has 60 hours. It contains basic knowledge of Electromagnetism that complements Physics I.

Physics II is needed to enroll for Physical Chemistry.

The Course is both of theoretical and experimental nature. The following objectives are pursued:

a) Homogenize, complete and increase the level of knowledge, concepts and fundamental principles of Physics.

b) Allow students to be able to use physical concepts and fundamental principles of Physics in several situations

c) Provide the student with the skills required for the further study of other subjects.

The Laboratory sessions will be given by Roberto Iglesias and the CE, PA and TG sessions will be given by Maria Luisa Sánchez.

3. Requirements

There are no compulsory requirements, but the students are recommended to be able to describe the most important physical phenomena, as well as to know the main concepts, laws and results of a basic course in Physics, as usually followed at a pre-university level. Essential knowledge of mathematical concepts and fluency in mathematical operations are needed, as well as acquaintance with the elemental techniques of differential and integral calculus.

4. Competencies and learning results

General skills:

- Show analytical and synthetical skills (CG-1).
- Effective problem solving (CG-2).
- Suitable information management (CG-6).
- Use of English as a foreign language (CG-7).
- Correct spoken and written English (CG-8).
- Ability to learn autonomously (CG-9).
- Ability to develop a critical thinking (CG-17).
- Team-working skills (CG-18).

Specific skills - Know-how:

- Relate macroscopic properties to individual atomic and molecular properties (CE-2).
- Identify the main features of the different states of matter as well as the theories used to describe them (CE-4).

Specific skills - Abilities:

- Solve qualitative and quantitative problems by means of previously developed models (CE-20).
- Implement best scientific experimental and measurement practices (CE-23).
- Plan, design, and perform practical investigations, moving from the problem-discovery stage to the assessment and evaluation of the results and findings (CE-28).
- Explain data originated in laboratory observations and measurements as a function of their meaning and the theory they are supported by (CE-30).
- Perform uncertainty calculations and analyses characterised by a proper usage of magnitudes and units (CE-35).
- Write down, present and defend scientific reports, both in spoken and written form, before an audience (CE-36).

The aforementioned skills are reflected on the following learning process results:

1. Prepare and present a correct report, both in spoken and written form. Following each laboratory sessions that will be undertaken during the Course, the students will prepare and present a report in written form for each one of the experiments performed. As part of the transversal activities proposed, students will read a Physics-related educational book to subsequently fill in a summary report that will be presented in spoken form before their classmates and the faculty. Additionally, as a team-work assignment, they will have to write down a report on a subject proposed by the teaching staff. The report will be summarised in a poster that the students will present and defend before their classmates. (CG-1, CG-6, CG-7, CG-8, CG-12, CG-18, CG-20, CE-20, CE-21, CE-22 and CE-36)
2. Formulate and solve problems that fall within the scope of Physics. During the group tutorial sessions, problems will be proposed. The student should solve them in a place other than the lecture hall, either individually or in a team. On top of that, the problems included in the exams taken during the Course will allow assessing the adequacy of the learning results to the proposed skills. (CG-2, CG-6, CG-9, CG-17 and CG-18)
3. Show and make proper use of the basic scientific knowledge gained during the Course. The assessment of this particular learning outcome will be done via the exams and the participation of students in seminars and group tutorial sessions. (CE-1, CE-2, CE-3, CE-4, CE-5, CE-7, CE-9 and CE-22)
4. Use the basic terminology of Physics with correction. Express ideas with the precision required in the scientific world, while establishing relationships among diverse concepts. This learning outcome will be assessed via exam taking. (CE-1).
5. Use the laboratory equipment and apply the basic safety regulations to work in the laboratory. The experimental sessions included in the Course are designed to assess the adequacy of the learning outcome to the assigned skills. (CE-23, CE-24, CE-25, CE-27, CE-28, CE-30, CE-32, CE-33, CE-34, CE-35 and CE-36).
6. Apply basic laboratory techniques that include the necessary calculations, while at the same time suitably expressing the results. The assessment of this outcome derives from the realization of the lab experiments, as well as from the use of a notebook that shows every observation taken during the practical sessions. (CE-23, CE-24, CE-25, CE-27, CE-28, CE-30, CE-32, CE-33, CE-34, CE-35 and CE-36).

5. Contents

1. ELECTRIC FIELD (6 hours)

1.1- Electric charge. Conductors and insulators. 1.2- Coulomb’s law. 1.3- Electric field. Superposition principle. 1.4- Electric dipole. 1.5- Gauss’s law and applications. 1.6- Charge and field at conductor surfaces.

2. ELECTRIC POTENTIAL (5 hours)

2.1- Electric potential and potential difference. 2.2- Electrostatic potential energy. 2.3- Gradient and equipotential surfaces.

3. CAPACITORS AND DIELECTRICS (4 hours)

3.1- Capacitance and capacitors. 3.2- Dielectrics: phenomenological description. 3.3- Gauss's law in material media. 3.4- The storage of electrical energy. Combinations of capacitors.

4. ELECTRIC CURRENT (5 hours)

4.1- Electric current. Ohm's law. 4.2- Energy in electric circuits. Combinations of resistors. 4.3- Direct-Current circuits. Kirchhoff's laws. 4.4- RC circuits.

5. THE MAGNETIC FIELD (6 hours)

5.1- The force exerted by a magnetic field on a moving charge. Applications. 5.2- The magnetic field created by currents. The Biot-Savart's law. 5.3- Gauss's and Ampère's laws.

6. MAGNETIC INDUCTION (6 hours)

6.1- Magnetic flux. Induced electromotive force and Faraday's and Lenz's laws. 6.2- Inductance. 6.3- Magnetic Energy. 6.4- Magnetic materials. H field. Ampère's law in matter. 6.5- Maxwell's equations.

7. ELECTROMAGNETIC RADIATION AND PRINCIPLES OF OPTICS (4 hours)

7.1- Electromagnetic waves and electromagnetic spectrum. 7.2- Electromagnetic wave production. 7.3- Energy and momentum of an electromagnetic wave. 7.4- Interference and diffraction. 7.5- Nature of light. Light propagation: Fermat's and Huygens-Fresnel principles. 7.6- Geometrical optics.

6. Methodology and working plan

The fulfilment of the specific objectives planned requires the contents of the Course to be exposed in the basics lectures, the problem-solving lectures, the group tutorial sessions and the laboratory sessions. Additionally, the Course is integrated in some of the joint activities that have been scheduled.

During the *Basics lectures (CE)* the lecturer will first present the structure of each chapter and indicate its relationship to the chapters that have been studied previously. In a systematic and coherent way, he/she will expound on its theoretical contents via an oral presentation that will make use of the blackboard and auxiliary projectors. Additionally, he/she will solve some questions and problems in order to strengthen the theoretical understanding and the knowledge of the possible applications by the students.

Problem-solving lectures (PA) are dedicated to the analysis and specific application of the theoretical knowledge acquired during the Basics lectures. Questions and problems proposed beforehand will be solved with the support and orientation of the lecturer.

Group tutorial sessions (TG): In order to accomplish what was agreed on the "Junta de Facultad de Química" on June 22, 2015, related to the TG sessions, the questions and exercises to be solved during these sessions, individually or in group, will be available on advance with time enough, and during the *Group tutorial sessions (TG)* the students will present the proposed exercises and the lecturer will clarify the questions from the students. During the last session, students will work on a written practical case.

In the *Laboratory sessions (PL)*, the students will carry out simple experiments to get acquainted with the handling of measurement apparatuses, at the same time learning basic experimental data acquisition and analysis techniques, as well as applying the knowledge they have acquired during the Course. Every student will write down in his laboratory notebook, which will always be available to the lecturer, all the observations and measurements undertaken. With them, and following the instructions received, he/she will work out and present a report at the end of the Course.

Other activities (OA) are devoted to promote joint activities with the other subjects of the semester. The students are expected to attend the reading workshops or interdisciplinary seminars, following the planning and coordination agreed by the teaching staff.

The total academic load is shown in the following table:

CATEGORIES		Time	Total
On-campus	Basics lectures	36	60
	Problem-solving lectures	7	
	Laboratory sessions	6	
	Group tutorials	4	
	Other activities	4	
	Assessment sessions	3	
Off-campus	Team work	15	90
	Individual work	75	
	Total	150	150

7. Evaluation of the student's learning results

Aspect	**Criteria**	**Instrument**	**Weight**
Attendance	Active participation	Docent's records.	20%

	in TG (10%). Performance in the laboratory (10%).	Assessment of the student's activity in TG and PL and evaluation of the laboratory report.	
Attendance	Participation in "joint activities"	Workshops. Week of Science. Interdisciplinary seminar.	10%
Written Exams	Mastering of contents and degree of accomplishment of objectives.	Written exams	70%

- Written exam: a unique written exam will be made in order to prove the mastering of the exposed contents (practical questions and problems). **A minimum score of 5 out of 10 is required**
- Participation in joint activities: the workshops, week of Science, and interdisciplinary seminar will be evaluated according to the criteria collected in the corresponding joint activity guides. **A minimum score of 5 out of 10 is required**.
- Active participation in tutored classes and laboratory: individual work will be handed out to the students. The correctness of answers and explanations given in the blackboard will be taken into account, with special interest on everything that proves a personal elaboration of the work performed. The attendance to PL sessions is mandatory. Participation in the laboratory will be evaluated. At the end of the laboratory sessions a report on the entirety of the experiments performed must be submitted. It should contain all the measurements and their respective analysis and should be delivered no later than 15 days after the end of the PL sessions. **A minimum score of 5 out of 10 is required**.
- Activities of PL, TG, and "joint activities" in case they are organized, will have the same weight in the continuous assesment score (30% of final score).
- Attendance to PL will be mandatory except for a justifiable reason.
- In the extraordinary exams it will be possible to make up for the written exam (70% of the final score), while maintaining the rest of the marks (PL, TG, and joint activities, 30% of the final score). The students who are retaking the Course will also maintain their marks from PL, TG and joint activities (30% of the final score).

8. Resources, bibliography and complementary documentation

The extra materials for the Course will be available via the Virtual Campus platform. These materials may consist on problem sheets for the PA lectures, questions for preparing the TG sessions, or summaries.

Basic bibliography:

-Tipler/Mosca, "Physics for Scientists and Engineers", Volume 2, sixth edition

-Sears, Zemansky, Young, Freedman, "University Physics with Modern Physics", 13th edition (2011)

-M.Alonso, E.Finn, "Physics", (1992).

The second volume of any of these books covers the program of General Physics II.