SUBJECT PROGRAMME

Academic Year: 2019-2020

Subject Information			
Code	501058	ECTS Credits	6
Course name (English)	Physics II		
Course name (Spanish)	Física II		
Degrees programs	Electrical Engineering (Industrial Fields) Electronics and Automatic Engineering (Industrial Fields) Mechanical Engineering (Industrial Fields) Industrial Technologies Engineering		
Faculty/School	School of Industrial Engineering		
Semester	2nd	Type of course	Obligatory-Basic
Module	Basic Training		
Field	Physics		

Lecturer/s			
Name	Office	E-mail	Web site
CARLOS ALBERTO GALÁN GONZÁLEZ	D.2.1	cgalango@unex.es	http://campusvirtual.unex.es/
MARÍA LUISA GONZÁLEZ MARTÍN	A108-Física	mlglez@unex.es	http://campusvirtual.unex.es/
PILAR SUÁREZ MARCELO	D.2.12	psuarez@unex.es	http://campusvirtual.unex.es/
RICARDO CHACÓN GARCÍA	D.2.3	rchacon@unex.es	http://campusvirtual.unex.es/
JUAN DE DIOS SOLIER GARCÍA	B105-Física	jsolier@unex.es	http://campusvirtual.unex.es/

Subject Area	Applied Physics
Department	Applied Physics
Coordinating Lecturer (if more than one)	Ricardo Chacón García

Competencies * (see table in http://bit.ly/competenciasGrados)

Basic		General		Transversal		Specific (Basic Training)		Specific (Common to Industrial Fields)		Specific (Specific Technologies)	
CB1	X	CG1		CT1	X	CEFB1	X	CECRI1		CETE1	
CB2	X	CG2		CT2	X	CEFB2	X	CECRI2		CETE2	
CB3	X	CG3		CT3	X	CEFB3		CECRI3		CETE3	
CB4	X	CG4		CT4	X	CEFB4		CECRI4		CETE4	
CB5	X	CG5		CT5	X	CEFB5		CECRI5		CETE5	
		CG6		CT6	X	CEFB6		CECRI6		CETE6	
		CG7		CT7	X			CECRI7		CETE7	
		CG8		CT8	X			CECRI8		CETE8	
		CG9		CT9	X			CECRI9		CETE9	
		CG10		CT10				CECRI10		CETE10	
		CG11						CECRI11		CETE11	

* The sections concerning competencies, course outline, educational activities, teaching methodologies, learning outcomes and assessment systems must conform to that included in the ANECA verified document of the degree program.

								CECRI12			

Contents

Course outline *

Field Theory. Electric and potential fields. Electric current. Direct current circuits. Magnetic field. Electromagnetic induction. Electromagnetic waves.

Course syllabus

Tiopic 1: **Electric Field and Potential**
Contents of Topic 1:
1.1. Differential operators. The Divergence and Stokes' Theorems.
1.2. Electric field and displacement vector.
1.3. Electric potential. Connection with the electric field.
1.4. Electric flux. 1st Maxwell Equation.

Topic 2: **Conductors, dielectrics and capacitors**
Contents of Topic 2:
2.1. Properties of conductors in electrostatic equilibrium.
2.2. Cavities in a conductor.
2.3. Electric field on the surface of a conductor.
2.4. Dielectrics. Polarization vector.
2.5. Capacitors. Capacitance.
2.6. Energy stored by a capacitor.
Laboratory session 1: Plate capacitor
Type: Laboratory.
Duration: 2.5 h

Topic 3: **Electric current and direct current circuits**
Contents of Topic 3:
3.1. Definition. Main physical magnitudes.
3.2. Continuity equation. Steady electric currents.
3.3. Filiform wires. Kirchhoff Rules.
3.4. Ohm's Law.
3.5. Energy dissipation in a conductor: Joule's effect.
3.6. Electromotive force.
3.7. Electric circuits. Resolution methods for direct current circuits.
Laboratory session 2: Direct current circuit
Type: Laboratory.
Duration: 2.5 h

Topic 4: **Magnetostatics**
Contents of Topic 4:
4.1. Magnetic induction vector in vacuum.
4.2. Lorentz force. Force on an electric current element. Force between steady current-carrying conductors.
4.3. Biot-Savart Law. Magnetic field by a moving charge and by a continuous charge distribution.
4.4. Magnetic field intensity in vacuum.
4.5. Ampère's Law. Ampère's Law for filiform currents. Stoke's Theorem. Differential expression of Ampère's Law.
4.6. Magnetic field inside a solenoid.
4.7. Magnetic flux. 2nd Maxwell Equation.
4.8. Self-inductance coefficient for a solenoid.
Laboratory session 3: Magnetic field inside a solenoid
Type: Laboratory.
Duration: 2.5 h

Topic 5: **Electromagnetic induction and electromagnetic waves**
Contents of Topic 5:
5.1. Induced electromotive force. Faraday-Lenz Law.

* The sections concerning competencies, course outline, educational activities, teaching methodologies, learning outcomes and assessment systems must conform to that included in the ANECA verified document of the degree program.

5.2. Mutual-inductance coefficients.
5.3. Energy stored by a solenoid.
5.4. Maxwell-Ampère Equation.
5.5. Maxwell Equations.
5.6. Electromagnetic wave equation in free space in absence of sources. Flat wave solution. Harmonic wave.
5.7. Energy and power flux of harmonic waves.
5.8. Electromagnetic spectrum.
Laboratory session 4: Electromagnetic induction.
Type: Laboratory.
Duration: 2.5 h

Educational activities *

Student workload in hours by lesson		Lectures	Practical activities				Monitoring activity	Homework
Lesson	Total	L	HI	LAB	COM	SEM	SGT	PS
1. Electric Field and Potential	22	11						11
2. Conductors, Dielectrics and Capacitors.	21	9		2,5			1,5	8
3. Electric Current and Direct Current Circuits.	22,5	9		2,5				11
4. Magnetostatics.	24	9		2,5			1,5	11
5. Electromagnetic Induction and Electromagnetic Waves.	22,5	8		2,5				12
Partial examination	13	2						11
Assessment *	25	2						23
TOTAL ECTS	**150**	**50**		**10**			**3**	**87**

L: Lectures (100 students)
HI: Hospital internships (7 students)
LAB: Laboratory or field practices (15 students)
COM: Computer room or language laboratory practices (30 students)
SEM: Problem classes or seminars or case studies (40 students)
SGT: Scheduled group tutorials (educational monitoring, ECTS type tutorials)
PS: Personal study, individual or group work and reading of bibliography

Teaching Methodologies *

	Used methodologies labelled as "X"
1. Explanation and discussion of theoretical contents.	X
2. Resolution, analysis and discussion of support examples or previously proposed exercises.	X
3. Exposition of related topics by students.	
4. Development of case studies or demonstrations at laboratory, computer room, etc.	X
5. Resolution of specific doubts in small groups in order to identify potential problems in the teaching-learning process, and academic guidance for essays, case studies, practical works, demonstrations, etc.	X
6. Search for information prior to the development of the topics, or for complementary information once they are in progress.	X
7. Preparation of essays, either individually or in groups.	
8. Study of each topic, which may consist of: content study, analysis of practical exercises or case studies, preparation for examinations, etc.	X

* The sections concerning competencies, course outline, educational activities, teaching methodologies, learning outcomes and assessment systems must conform to that included in the ANECA verified document of the degree program.

Learning outcomes *

Acquire the basic concepts related to Field Theory as well as those of electric field and electric potential, for different charge distributions. Apply the Superposition Principle and identify adavantageous simmetries in order to face practical exercises. Regard Gauss' Theorem as derived from the concepts of solid angle and equipotential surface. Understand the concept of conducting material, also accounting for the case of conductors with internal cavities. Achieve the basic concepts relating dielectrics, at the macroscopic scale, as related to the study of capacitors. Achieve the concept of electric current, continuity equation and electromotive force. Acquire fluency in the resolution of DC electric circuits. Introduce the concept of Lorentz force and expand it to the case of electric currents. Understand the concept of magnetic field created by a point charge and as well as by electric current distributions, stressing the particular case of electric currents flowing along filiform conducting wires. Learn Ampère's Law and apply it to some particular cases of special relevance in engineering, such as infinite rectilinear electric currents and the straight or the toroidal solenoid. Acquire the concept of electromagnetic induction and apply it to standard configurations of interest. Understand the concept of electromagnetic wave.

Assessment systems *

Assessment criteria:

CR1. Correct understanding of concepts, theorems and laws involved in the answers to examination questions. Clarity of explanations and coherent use of language will be accounted for. CB1-5, CT1-7, CEFB2.

CR2. Accurate explanations along problem solving. Final solutions will be accounted for only if appropriate units are included and a coherent method is developed. CB1-5, CT1-6, CEFB1, CEFB2.

CR3. Clarity and accuracy in the use of diagrams when appropriate. CB1-5, CT1-6, CEFB2.

CR4. Application of the scientific method (mainly regarding the laboratory sessions). CB1-5, CT1-6, CEFB2.

CR5. Appropriate group-working habilities. CT8, CT9.

Activities	**Ordinary call**	**Extraordinary call**	**Global evaluation**
1. Final and/or partial examinations	80%	80%	80%
2. Activities dealing with laboratory reports, computer works, case studies, visits, etc.	20%	20%	20%

CONTINUOUS EVALUATION:

Assessment activity 1.

A. Partial written examination: CR1, CR2, CR3 (NON-REPEATABLE)

Students will take an eliminatory partial examination which will contribute to the final mark in a percentage according to the extension of the evaluated contents. At least five points out of ten need to be achieved in order to pass the examination –and thus to eliminate the contents-. If a mark lower than 5 but equal or greater than 4 is achieved, the contents of the partial examination will be eliminated if the weighted average between the mark in the partial examination and the mark in the second part of the final examination is equal or greater than 5 points out of ten. Any mark below

* The sections concerning competencies, course outline, educational activities, teaching methodologies, learning outcomes and assessment systems must conform to that included in the ANECA verified document of the degree program.

4 in the partial examination will not be accounted for in the computation of the final mark.

B. Final written examination: CR1, CR2, CR3 (80%, REPEATABLE)

It will be a written exercise (WE) consisting of two well differentiated parts, one referring to the topics evaluated in the partial examination and a second one accounting for the remaining contents of the subject. The two parts will be weighted in terms of their contribution to the final mark according to the number of the corresponding topics as compared to the total contents of the subject.

Requirement for the mark achieved in "assessment activity 2" to be accounted for:
WE ≥ 4 out of 10 (computed as the average mark of Part1 and Part2),
with Part1 ≥ 3 out of 10 and Part2 ≥ 3 out of 10

Assessment activity 2.

C. Laboratory reports: CR1, CR4, CR5 (20%, NON-REPEATABLE)

Students will be asked to upload a brief laboratory report file after each of the four lab sessions, which will be contribute to the final mark as 5% each so that this assessment activity will yield a maximum of 2 points out of ten in the final mark (i.e. 20%) (whenever the requirement noted in the last paragraph of "assessment activity 1" is accomplished).

Computation of final mark for the option "continuous evaluation":

FINAL MARK = 0.8 WE + 0.2 C
The student will fail unless the final mark is equal or greater than 5, with WE≥4.

Whenever any of the required conditions to pass the subject is not accomplished, the final mark will be set as 4 in case the result yielded by the abovementioned formula exceeds that particular value.

The mark achieved either in the partial examination or in the corresponding part of the final examination, if equal or greater than 5, will remain for each of the two calls along the semester so that students will not be asked to attend the final examination on the corresponding contents. However, the students meeting such situation who decide to attend the final examination would achieve a mark in the associated part of the contents computed as the highest of the two (the former mark in the partial examination and that of the corresponding part in the final examination).

GLOBAL EVALUATION:

It will take place the same date as the final examination associated to the "continuous evaluation", and will consist of the two following activities:

Assessment activity 1.- Final written examination (Part1 and Part2): CR1, CR2, CR3 (80%, REPEATABLE)

The examination will be divided into Part1 and Part2, according to the same parts of the contents (and with the same weights) regarding the "continuous evaluation" option. Provided it is a global evaluation, this examination will cover the two parts of the contents for all students in the two calls.

No individual parts of the final examination will be eliminated for the second call along the semester.

Assessment activity 2.- Laboratory examination: CR1, CR4, CR5 (20%, REPEATABLE)

This activity consists of a written examination on the contents developed within the four programmed laboratory sessions.

---

* The sections concerning competencies, course outline, educational activities, teaching methodologies, learning outcomes and assessment systems must conform to that included in the ANECA verified document of the degree program.

Computation of final mark in the "global evaluation" option:

Let WAM the weighted average mark between those of Part1 and Part2, and let LE be the mark achieved in the Laboratory examination:

FINAL MARK = 0.8 WAM + 0.2 LE

The subject will not be passed unless the final mark is equal or greater than 5, with WAM≥4 out of 10 and marks in Part1 and Part2 ≥ 3 out of 10.

Whenever any of the required conditions to pass the subject is not accomplished, the final mark will be set as 4 if the result yielded by the abovementioned formula exceeds that particular value.

Bibliography (basic and complementary)

Basic

- P. Suárez. *Apuntes de Física* (2 vols.). Ed. Escuela de Ingenierías Industriales. UEx
- P. Suárez y C.A. Galán. Manual de laboratorio.

Complementary

- Eisberg/Lerner. *Physics. Fundamentals and Applications*. (2 vols). Ed. Mc Graw Hill
- Gettys/Keller/Skove. *Classical and Modern Physics*. Ed. Mc Graw Hill
- Rubio Royo. *Física. Conceptos básicos*. (2 vols). Ed. Interinsular Canaria.
- Serway. *Physics*. (2 vols) Ed. Mc Graw Hill
- Tipler. *Physics*. (2 vols). Ed. Reverté, S.A.
- Alonso/Finn. *Physics. Vol. II Fields*.
- Civit. *Lecciones de Física*. Ed. Doncel, I.G.
- Feynmam. *Physics*. (3 vols). Fondo Educativo Interamericano, S.A.
- Ortega. *Lecciones de Física*. Ed. Universidad de Córdoba.

Other resources and complementary educational materials

Web resources

- http://campusvirtual.unex.es
- http://www.dfists.ua.es/experiencias_de_fisica/index18.html
- http://www.explora.cl/index.php?option=com_content&view=article&id=93&Itemid=75
- http://www.lawebdefisica.com/
- http://www.sc.ehu.es/sbweb/fisica/default.htm
- http://phet.colorado.edu/en/simulations/category/physics
- http://physicsworld.com/
- http://www.physics.org/

* The sections concerning competencies, course outline, educational activities, teaching methodologies, learning outcomes and assessment systems must conform to that included in the ANECA verified document of the degree program.