COURSE PROGRAM

Academic Year: 2020/2021

Identification and characteristics of the course			
Code	501058 503010*	ECTS Credits	6
Course name (English)	Physics II		
Course name (Spanish)	Física II		
Degrees programs	Electrical Engineering (Industrial Fields) Electronics and Automation 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			
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Subject Area	Applied Physics
Department	Applied Physics
Coordinating Lecturer (if more than one)	Carlos Alberto Galán González

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	

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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.

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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

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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.

Assessment activities:

	Range	Ordinary call	Extraordinary call	Global evaluation
1.- Final and/or patial examinations	0% - 80%	50%	50%	80%
2.- Activities dealing with laboratory reports, computer works, case studies, visits, etc.	0% - 50%	20%	20%	20%
3.- Resolution and hand-in of activities (problems, case reports, essays, project reports, etc.) either individually or in groups.	0% - 50%	30%	30%	0%

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CONTINUOUS EVALUATION MODE:

ASSESSMENT ACTIVITY 1.

A. QUESTIONNAIRE TOPICS 1-3 (*QUEST1*, over 10 points): CR1, CR2, CR3
(18%) NON-REPEATABLE

B. QUESTIONNAIRE TOPICS 4-5 (*QUEST2*, over 10 points): CR1, CR2, CR3
(12%) NON-REPEATABLE

C. WRITTEN FINAL EXAMINATION (*WFE*, over 10 points): CR1, CR2, CR3
(50%) REPEATABLE
It will consist of two parts: Part 1 and Part 2, with percentage weights 30% and 20%, respectively.
The score of each part will be accounted for the extraordinary call whenever it is equal or greater than 5 points (out of 10).

In order to add the marks corresponding to the rest of the assessment activities the score for each of the two parts in this final examination must be equal or greater than 3 points out of 10 and, as well, the mean weighted score of the two parts must be equal or greater than 4 points out of 10.

ASSESSMENT ACTIVITY 2.

D. LABORATORY REPORTS (*LAB*, over 10 points): CR1, CR4, CR5
(20%) NON-REPEATABLE
The student should hand in a total of 4 laboratory reports after the corresponding laboratory sessions from the collected experimental data. Each of those reports will have a percentage weight of 5% in the final mark of the course.

COMPUTATION OF THE FINAL MARK OF THE COURSE IN THE CONTINUOUS EVALUATION MODE:

$$\text{FINAL MARK OF COURSE} = (QUEST1 \cdot 0{,}18) + (QUEST2 \cdot 0{,}12) + (LAB \cdot 0{,}2) + (WFE \cdot 0{,}5)$$

In order to pass the course, the final mark computed as in the above expression must be equal or greater than 5 points out of 10, with $WFE \geq 4$ points and also with the marks of each of the parts of the examination equal or greater than 3 points (out of ten).

Whenever any of the requirements described in the previous paragraph is not satisfied, the final mark of the course will be taken as the minimum value of the two following: the mark computed from the abovementioned expression and 4 points.

GLOBAL EVALUATION MODE

The global evaluation will be scheduled on the same date as that of the written final examination of the continuous evaluation mode, as indicated by the corresponding academic authority in the School of Industrial Engineering.
It will consist of the two following activities:

ACTIVIDAD DE EVALUACIÓN 1.

WRITTEN FINAL EXAMINATION (*WFE*, over 10 points): CR1, CR2, CR3
(80%) RECUPERABLE
It will be a written examination and will be divided into two parts (Part 1 and Part 2, corresponding to Topics 1-3 and 4-5 and with percentage weights as 48% and 32%,

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respectively).
Provided this evaluation mode is based on a global assessment, the marks achieved in each of those parts will not be accounted for in the extraordinary call of the course.

ACTIVIDAD DE EVALUACIÓN 2.

LABORATORY EXAMINATION (*LAB*, over 10 points): CR1, CR4, CR5
(20%) RECUPERABLE
This activity will consist of an examination on the contents developed along the laboratory sessions in the course designed for the continuous evaluation mode.

CÁLCULO DE LA CALIFICACIÓN FINAL DE LA ASIGNATURA EN LA MODALIDAD DE EVALUACIÓN GLOBAL

$$\text{CALIFICACIÓN FINAL EN ACTA} = (0{,}8 \cdot EFE) + (0{,}2 \cdot LAB)$$

In order to pass the course, the final mark computed as in the above expression must be equal or greater than 5 points out of 10, with $WFE \geq 4$ points and also with the marks of each of the parts of the examination equal or greater than 3 points (out of ten).

Whenever any of the requirements described in the previous paragraph is not satisfied, the final mark of the course will be taken as the minimum value of the two following: the mark computed from the abovementioned expression and 4 points.

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

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- 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/

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