Bachelor in Mechanical Engineering

Course information

Year 2018-19

GENERAL SPECIFICATIONS				
English name				
Physics II				
Spanish name				
Física II				
Code		**Type**		
606410107		Compulsory		
Time distribution				
	Total	**In class**	**Out class**	
Working hours	150	60	90	
ECTS: 6				
Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
4,14	0.36	1.5		
Departments		**Knowledge areas**		
Ciencias Integradas		Física Aplicada		
Year		**Semester**		
1º		2º		

TEACHING STAFF			
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SPECIFIC INFORMATION OF THE COURSE
1. Contents description
1.1. In English:
Electrostatics - Electrical Circuits - Magnetostatics - Magnetic Induction - Thermodinamics
1.2. In Spanish
Campo eléctrico. Corriente eléctrica. Campo magnético. Inducción electromagnética. Termodinámica.
2. Background
2.1.Situation within the Degree:
The course is offered the second semester of the first year. It is a continuation of the course Physics I, offered the first semester. Also, it is related to the first year courses Mathematics I and II.
2.2. Recommendations:
It is highly recommended to have taken previous courses in Physics and Mathematics at the High School level.
3. Objectives (as result of teaching):
The fundamental objective in that the student learns the basic concepts on the electromagnetic theory and acquires the skills to apply them in the understanding and

solving engineering problems. Other objectives are:

1. To understand the basics concepts and theories of Physics.
2. To apply Physics laws to solve problems.
3. To get familiar with the scientific language: Graphics, mathematical language ...
4. Ability to search for bibliography.
5. To get introduce in the experimental techniques.
6. Capability for team work.

4. Skills to be acquired

4.1. Specific Skills:

B02 Understanding of the basic concepts on the general laws of the mechanics, thermodinamics, field theory, waves and electromagnetism, along with their application to the resolution of the engineering problems.

4.2. General Skills:

CB1: Ability of the students to acquire knowledge and understand topics previously studied in high school, that in the course are presented with a higher level, including concepts at the research level.

CB2: Ability of the students to apply their knowledge to their work and use the skills needed to become good professionals on their field by using accurate argumentation techniques and problem solving skills.

CB3: Ability of the students to gather information and perform an accurate interpretation of the data to be able to make precise judgements on social, scientific or ethical topics.

G01: Ability to solve problems.

G04: Ability to apply theoretical concepts to practical situations.

G07: Capability for analysis and synthesis.

5. Training Activities and Teaching Methods

5.1. Training Activities:

Lectures on the contents of the program. Laboratory sessions. Individual and group tutoring.

5.2. Teaching Methods:

Master classes, encouraging student participation.
Group work in lab sessions.
Follow up of the understanding of the course contents in problem sessions.
Individual tutoring.
Written exams.

5.3. Development and Justification:

Master class: Exposition of the theoretical contents of the course.
Problems and exercises: Application of the theoretical concepts. The ability to solve problems determines the understanding of the theory.
Laboratory sessions: the students will perform experiments that are related to the contents of the course. They will have to work in small groups aim to check physical laws and concepts.

6. Detailed Contents:

1 ELECTRIC CHARGE AND ELECTRIC FIELD
1.1 Electric Charge.
1.2 Conductors, Insulators, and Induced Charges.
1.3 Coulomb's Law.
1.4 Electric Field and Electric Forces.
1.5 Electric-Field Calculations.
1.6 Electric Field Lines.
1.7 Electric Dipoles.

2 GAUSS'S LAW
2.1 Charge and Electric Flux
2.2 Calculating Electric Flux.
2.3 Gauss's Law.
2.4 Applications of Gauss's Law.
2.5 Charges on Conductors

3 ELECTRIC POTENTIAL
3.1 Electric Potential Energy.
3.2 Electric Potential.
3.3 Calculating Electric Potential.
3.4 Equipotential Surfaces.
3.5 Potential Gradient

4 CAPACITANCE AND DIELECTRICS
4.1 Capacitors and Capacitance.
4.2 Capacitors in Series and Parallel.
4.3 Energy Storage in Capacitors.
4.4 Dielectrics.

5 CURRENT, RESISTANCE, AND ELECTROMOTIVE FORCE. 5.1 Current.
5.2 Resistivity.
5.3 Resistance.
5.4 Electromotive Force and Circuits.
5.5 Energy and Power in Electric Circuits.
5.6 Theory of Metallic Conduction.

6 DIRECT-CURRENT CIRCUITS.

6.1 Resistors in Series and Parallel.
6.2 Kirchhoff's Rules.

7 MAGNETIC FIELD AND MAGNETIC FORCES.
7.1 Magnetism.
7.2 Magnetic Field.
7.3 Magnetic Field Lines and Magnetic Flux.
7.4 Motion of Charged Particles in a Magnetic Field.
7.5 Applications of Motion of Charged Particles.
7.6 Magnetic Force on a Current-Carrying Conductor.
7.7 Force and Torque on a Current Loop.
7.8 The Direct-Current Motor.

8 SOURCES OF MAGNETIC FIELD.
8.1 Magnetic Field of a Moving Charge
8.2 Magnetic Field of a Current Element
8.3 Magnetic Field of a Straight Current-Carrying Conductor.
8.4 Force Between Parallel Conductors
8.5 Magnetic Field of a Circular Current Loop.
8.6 Ampere's Law
8.7 Ampere's Law Applications.

9 ELECTROMAGNETIC INDUCTION.
9.1 Induction Experiments.
9.2 Faraday's Law.
9.3 Lenz's Law
9.4 Motional Electromotive Force.
9.5 Induced Electric Fields.
9.6 Eddy Currents.
9.7 Displacement Current and Maxwell's Equations. 9.8 Mutual Inductance.
9.9 Self-Inductance and Inductors.

10 ELECTROMAGNETIC WAVES
10.1 Maxwell's Equations and Electromagnetic Waves.
10.2 Plane Electromagnetic Waves and the Speed of Light.
10.3 Sinusoidal Electromagnetic Waves.
10.4 Energy and Momentum in Electromagnetic Waves.
10.5 Standing Electromagnetic Waves

11 THERMODINAMICS
11.1 Introduction.
11.2 The zero principle and calorimetry.
11.3 First law.
11.4 Second law.

7. Bibliography

7.1. Basic Bibliography

F. W. Sears, M. W. Zemansky y H. D. Young, University Physics 13th Edicition. Ed. Addison- Wesley(2012).

7.2. Additional Bibliography:

There are many general physics manuals, some examples are:

P.A. Tipler & G. Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, W. H. & Company (2007)

R. A. Serway. Fisica, Ed. McGraw-Hill (1985).

R. Resnick, D. Halliday y K. S. Krane, Fisica, Ed. CECS (1994).

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8. Systems and Assessment Criteria

8.1. System for Assessment:

Written exam.
Lab reports.
Homework assigments.

8.2. Assessment Criteria and Marks:

Written exam (80%). Evaluation of skills B02, G01, G02, G07, G09 and G17.

Laboratory Mark (10% of the total grade). The 50% of the grade come from the report on laboratory experiments and the other half from an exam. Evaluation of skills G02, G04, G05 and G17.

Homework and solution of problems in class (10%). Evaluation of skills B02, G03, G05, G09 and G17

NOTE 1: The homework grade will only be considered for students that obtain more than 40% of the grade of the written exam.
NOTE 2: The students must achieve more than the 40% in both the theoretical and the laboratory parts of the course to obtain a passing grade.
NOTE 3: To attend laboratory sessions is mandatory and a requirement to pass the course.