TEACHING PROGRAMME

Academic Year: 2019/2020

Identification and characteristics of the course				
Code	501050		ECTS Credits	6
Course name (Spanish)	Física I			
Course name (English)	Physics I			
Degrees	DEGREES IN MECHANICAL ENGINEERING, ELECTRICAL AND ENGINEERING AND ELECTRONICS AND AUTHOMATICS ENGINEERING (Industrial branch) AND DEGREE IN MATERIALS ENGINEERING			
Faculty/School	INDUSTRIAL ENGINEERING SCHOOL			
Semester	1º	Type of course	MANDATORY/BASIC	
Module	BASIC TRAINING			
Matter	PHYSICS			

Instructor/s			
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Area	Applied Physics
Department	Applied Physics
Coordinator	FLORENTINO SÁNCHEZ BAJO

Competences*

*The sections related to competences, brief description of the contents, formative activities, teaching methodologies, learning results and evaluation systems, must fit the principles collected in the verified report of the title..

1. Basic competences (CB):
CB1 – To demonstrate that the knowledge has been acquired and understood, within a study area that includes contents starting from a high school level, and includes knowledge of advanced books, but also includes updated and innovating concepts.
CB2 – To apply the knowledge to a job, and acquired the skills that can be demonstrated by the development and description of arguments and resolution of problems, in the area of study.
CB3 – To acquire the skill of interpreting relevant data (within the area of study) to asses judgements including a reflexion on relevant issues of social, scientific and ethical character.
CB4 – To transfer information, ideas, problems and solutions to a specialized and non-specialized public.
CB5 – To develop learning skills needed to undertake further studies with a high degree of autonomy.

2. Transversal Competences (CT):
CT1 – To get the knowledge on basic and technological subjects, allowing to the inclusion of new methods and theories, and gives versatility to be adapted to new situations.
CT2 – To solve problems and to take decisions with initiative, creativity and critical thinking.
CT3 – To communicate and transfer knowledge, abilities in the field of engineering.
CT4 – To find, analyze, criticize, relate, structure and synthesize scientific and technical information from different sources.
CT5 – To apply information and communication technologies.
CT6 – To have motivation in regards to motivation and continuous improvement.
CT7 – To be able to effectively communicate in other languages, mainly in English.
CT8 – To have an ethical, responsible and respectable attitude with people and environment.
CT9 – To be able to work efficiently in multidisciplinary teams assuming different roles and responsibilities with absolute respect to the fundamental rights of equality between men and women.

3. Specific Competences FB
CEFB1: Ability for the resolution of mathematical problems typical of engineering. Aptitude to apply knowledge on: lineal algebra, geometry, differencial geometry, differencial and integral calculation, differencial equations and partial derivatives, numerical methods, numerical algoritms, statistics and optimization.

CEFB2: Understanding and command of the basic conceots on the general laws of mechanics, thermodynamics, electromagnetic waves and their application for the resolution of engineering problems.

Contents

Brief description of the contents*

Fundamental thermodynamics. Mechanics of particle systems: rigid solids, mechanical waves

Subject chapters:

Name of chapter 1: SYSTEMS OF UNITS

Name of unit 1: SYSTEMS OF UNITS
Contents of unit 1:
1.1. Definition of system of units
1.2. The international system of units (SI). Basic and derived units.
1.3. Conversion factors between units. The case of temperature.

Name of unit 2: FUNDAMENTAL THERMODYNAMICAL CONCEPTS

Contents of unit 2: 2.1. Thermodynamics. Thermodynamical systems. Classification. 2.2. Macroscopic and microscopic description of a thermodynamical system. Thermodynamical variables. 2.3. State of a system. Thermodynamical equilibrium. 2.4. Transformations or thermodynamical processes. Casiesthatic and non-sthatic processes. Thermodynamic interactions. Diagrams T-V and P-V. 2.5. Energetic concepts
Name of unit 3: STATE THERMAL EQUATIONS. IDEAL GAS. REAL GAS Contents of unit 3: 3.1. State thermal equations 3.2. State thermal equation of an ideal gas. Laws of an ideal gas. 3.3. Real gas. Comprensibility factor
Name of unit 4: PURE SUBSTANCES. DIAGRAMS AND THERMODYNAMIC TABLES 4.1. Pure substance. Homogeneous mixture. 4.2. Phases diagram. Saturation diagram. 4.3. Saturation tables. Compressed liquid and superheated steam. 4.4. Title or quality of a mixture. Humidity degree.
Name of unit 5: FIRST PRINCIPLE OF THERMODYNAMICS FOR CLOSED SYSTEMS 5.1. Determination of the thermodynamical work for a system undergoing a change in volume. 5.2. Thermal capacities. Heat exchanged through a process. 5.3. Formulation of the first principle for a closed system. 5.4. Joule Law. Isothermal process of an ideal gas. 5.4. Energetic equation of an ideal gas.
Name of unit 6: FUNDAMENTAL THERMODYNAMICAL PROCESSES 6.1. Polytropic processes. Polytropic index. 6.2. Equations of fundamental processes. Work calculation. 6.3. Energetic balance of an ideal gas. Entalphy calculation of an ideal gas. Practical activities: Seminar. The seminar, with a duration of 1 h, will be devoted to the resolution, analysis and discussion of problems from chapters 2 to 6. Special emphasis will be made on the general approach, and the discussion of problems previously proposed but not solved at previous lectures.
Name of unit 7: EQUILIBRIUM OF RIGID SOLIDS 7.1. Rigid solids (RS). 7.2. Internal and external forces. 7.3. Transmissibility principle. Equivalent forces. 7.4. Sliding vectors. Varignon Theorem. 7.5. RS Equilibrium equations. 7.6. Free solid diagram. 7.7. 2D solid: Reactions at connections and supports. Hiperstaticity degree.
Name of unit 8: GRAVITY CENTERS AND DISTRIBUTED FORCES 8.1. Parallel force systems. Gravity centre (GC). 8.2. GC determination. Centroids. First order Moments. 8.3. Properties of the GC of a system. 8.4. Pappus-Guldinus Theorems. 8.5. Loads distributed on beams.
Name of unit 9: INERTIAL MOMENTS FOR AREAS AND BODIES 9.1. Inertia moment of an area or second order moment.

9.2. Polar inertia moment.
9.3. Spinning radio of an area.
9.4. Steiner theorem.
9.5. Inertia moments of composed areas.
9.6. Inertia moment of a body.
Practical activities:
1. Problems seminar. The seminar, with a duration of 1 h, will be devoted to the resolution, analysis and discussion of problems from chapters 7 to 9. Special emphasis will be made on the general approach, and the discussion of problems previously proposed but not solved at previous lectures. This session will also mean a space to solve general questions.
2. Laboratory session: Inertia moment of a disc. Comprobation of Steiner theorem

Name of unit 11: RIGID SOLID DYNAMICS
11.1. Mass center of a solid (MCS). Velocity and acceleration of the MCS.
11.2. Equation of the translation dynamics of a solid.
11.3. Lineal moment of a solid. Conservation theorem.
11.4. Angular moment of a solid.
11.5. Equations of the rotation dynamics of a rigid solid.
11.6. Theorem of conservation of the angular moment
11.7. Kinetic energy and work associated to the movement of the rigid solid.
11.8. Potential energy of the rigid solid. Energy conservation. Actividades prácticas:
1. Problems seminar. The seminar, with duration of 1 h, will be devoted to the resolution, analysis and discussion of problems from chapter 11. Special emphasis will be made on the general approach, and the discussion of problems previously proposed but not solved at previous lectures. This session will also mean a space to solve general questions.

Name of unit 12: MECHANICAL WAVES
Practical activities:
1. Laboratory session: Mechanical waves. Stationary waves. Transversal waves on strings Longitudinal waves on springs.

Learning activities *

Student workload in hours		Theory lectures	Practical activities				Evaluation activities	Self-study
Unit	**Total**	**GG**	**PCH**	**LAB**	**ORD**	**SEM**	**TP**	**EP**
1	4	2						2
2	4	2						2
3	8	3						5
4	10	3						7
5	12	5						7
6	12.5	3				1	1.5	7
7	10	5						5
8	12	6						6
9	15	5		2		1		7
10	16	7				1		8
11	17.5	7				1	1.5	8
12	2			2				
Evaluation**	27	4						23
Partial exam units 1-6	9	2						7
Final exam	18	2						16
TOTAL	150	52		4		4	3	87

** Indicate the total number of evaluation hours included in this modality.

GG: Lectures (100 students)
PCH: Hospital clinical practices (7 students)
LAB: Laboratory or field practices (15 students)
ORD: Computer sessions or language laboratory (30 students)
SEM: Seminars or practical activities (40 students)
TP: Programmed tutorial sessions (ECTS)
EP: Self study, individual or group works, and bibliography reading.

Teaching methodologies*

Among the teaching methodologies included in the formative program, in this course the following are used:

Teaching methodology	Check with an "X" the ones used
1. Explanation and discussion of contents	X
2. Solution, analysis and discussion of examples and exercises	X
3. Oral presentation of assignments	
4. Development of practical cases in labs, computer rooms, seminars, etc.	X
5. Resolution of punctual questions in reduced groups, to detect possible problems in the teaching-learning process and help in the works, practices, and self-study.	X
6. Search of information prior to the explanation of the contents of an unit or search of complementary information once the activities of a unit have been developed	X
7. Elaboration of assignments either individually or in groups	
8. Study of each unit: study of contents, preparation of exercises or cases, preparation of the final exam, etc.	X

Learning outcomes*

Understand the basic concepts of fundamental thermodynamics. Apply the state equations to different thermodynamical systems. Understand the concept of thermodynamical work and apply it to specific cases. Understand the first principle of thermodynamics, Understand the different types of thermodynamic processes and the concept of enthalpy.
Understand the equilibrium equations of a rigid solid and know how to use them in particular situations. Calculate the gravity centers of bodies with different geometries. Differentiate the different types of motion of a rigid solid under specific circumstances. Calculate inertia moments and apply notions of energy and angular moment to a rigid solid. Understand the concept of lineal mechanical wave.

Assessment *

Assessment criteria

CR1. Correct assimilation of the concepts, theorems and laws of Physics, with special emphasis on the clarity and accuracy of explanations, as well as the suitable use of language. CB1-CB5; CT1-CT7; CEFB2.
CR2. Detailed explanation in the resolution of a problem. The (units included) will only be taken into account if the procedure followed for the resolution is correct. CB1-CB5; CT1-CT6; CEFB1, CEFB2.
CR3. Clarity and accuracy in the use of diagrams. Its inclusion when it applies will be valued. CB1-CB5; CT1-CT6; CEFB2.

CR4. Use of scientifical methods (especially in laboratory sessions and practical engineering cases). CB1-CB5; CT1-CT6; CEFB2.
CR5. Adequate behaviour of all members of a work group. Cooperation skills will be valued. CT8, CT9.

Assessment activities

Among the assessment activities included in the formative program, in this course the following are used:

	Range fixed in the verified memory	**Continuous evaluation** Ordinary call	**Continuous evaluation** Extraordinary call	**Global evaluation** All calls
1. Final exam and/or partial eliminatory examinations.	0%-80%	75	75	75
2. Practical activities in: classroom, lab, computers room, visits, etc.	0%-50%	15	15	25
3. Solution and submission of activities (cases, exercises, assignments, projects, etc.), individually and/or in groups. (GG, SEM, TP)	0%-50%	10	10	-
4. Active participation in the learning activities.	0%-10%	-	-	
5. Attendance to the learning activities.	0%-10%	-	-	

Description of the assessment activities

Evaluation activities (clarifications)

MODALITY OF CONTINUOUS EVALUATION

EVALUATION ACTIVITY 1.

A. ELIMINATING PARTIAL EXAM (EPE): CR1, CR2, CR3

(25%) NON RECOVERABLE

One eliminating written partial exam including the part of thermodynamics (T1 to T6). Two possible cases can be found, depending on the mark obtained in this exam:

a) **EPE ≥ 5 points over 10**: the student has the option of compesating this part of the subject in the final exam, as long as the mark obtained in part B is enough to provide an average weighted mark equal or higher than 5 over 10. This option is open to all calls of the term. The students under this circunstance can also attend the final written exam with two parts of the subject, as it is described in section B.
b) **EPE < 4 points over 10**: this part of the subject is not eliminated, and the students have to take an exam, as described in section B, with all the subject.

B. FINAL WRITTEN EXAM (FWE): CR1, CR2, CR3

(75%) RECOVERABLE

The final exam will be written. It will be divided in two parts: Mechanics and Thermodynamics. All the students will have to take an exam on the contents corresponding to the part of Mechanics. The students under the following circumstances will also have to take an exam on the part of thermodynamics:

- All students in the situation of section A.b).
- All students in the situation of sections A.a), who want to rise their mark. In this case, the best of both marks will be kept.

The weight of these parts in the final mark is weighted as a function of their amplitude in the program, and corresponds with a share of 25% to Thermodynamics and 50% to Mechanics. The mark obtained in each part of this exam **has to be** equal or greater than 3 over 10 and the average mark has to be at least 4 in order to get the other contributions added.

EVALUATION ACTIVITY 2.

C. LABORATORY SESSIONS (LAB): CR1, CR4, CR5

15% (NON RECOVERABLE)

The student must hang out a report about his/her work in the laboratory, using his/her experimental data, within the corresponding deadline. Each report will contribute with the same weight to this activity, so that a maximun of 1.5 points will be added, as long as the requirement specified in last paragraph of evaluation activity 1 is achieved.

EVALUATION ACTIVITY 3.

HAND OUT OF ACTIVITIES: CR1, CR2, CR3, CR4, CR5
10% (NON RECOVERABLE)
The students will hand out some works during the term, in groups. The numer and content of these works will be specified during the term, in advance. In general, this activity can have a mark up to 1 point, provided the last requirement specified in the last paragraph of the evaluation activity 1.

CALCULATION OF THE FINAL CALIFICATION OF THE SUBJECT. CONTINUOUS EVALUATION MODALITY:

MARK WRITTEN EXAM (MWE) = 25% Thermodynamics + 50% Mechanics
FINAL MARK = FEW + LAB +ENT

Conditions needed to add the marks obtained in LAB and y ENT EFE ≥ 4 (over 10), for Mechanics and Thermodynamics ≥ 3 (over 10)

Condition needed to pass the subject: FINAL SUBJECT ≥ 5

If any of the conditions needed to pass the subject is not achieved, the final subject mark will the the minimun between the final mark and 4.

CALCULATION OF THE FINAL CALIFICATION OF THE SUBJECT. GLOBAL EVALUATION MODALITY:

The global assessment will be held the same day scheduled for the final exam of each call. It will consist of the following parts:

EVALUATION ACTIVITY 1.

FINAL WRITTEN EXAM (FWE): CR1, CR2, CR3
(75%) RECOVERABLE
The exam, written, will be divided into two parts: with a share of 25% to Thermodynamics and 50% to Mechanics (the share of each part is related to their weight in the subject).
In this global evaluation, the marks obtained in each part of the written exam will not be kept from one call to another one of a term.

EVALUATION ACTIVITY 2.

EVALUATION ACTIVITY 2.

LABORATORY EXAM (LAB): CR1, CR4, CR5
(25%) RECOVERABLE
This exam consists in a written exam of the contents of the subject that have been worked in the lab.

CALCULATION OF THE FINAL QUALIFICATION OF THE SUBJECT IN THE MODALITY OF GLOBAL EVALUATION

FINAL EXAM MARK (FEM) = 25% Thermodynamics + 50% Mechanics
FINAL MARK= FWE + LAB
Conditions needed to add the marks obtained in LAB
FWE ≥ 4 (over 10), with Mechanics and Thermodynamics ≥ 3 (over 10)
Condition needed to pass:

FINAL MARK ≥ 5
If one of these conditions is not achieved, the final mark will the minimun between the final mark and 4.

Bibliography (basic and complementary)

Basic bibliography

1. Beer, Johnston y Eisenberg, Mecánica vectorial para ingenieros. Estática y Dinámica (McGraw Hill, 8a edición, 2007), also available at the electronic library site:
STATIC:
http://0-www.ingebook.com.lope.unex.es/ib/NPcd/IB_Escritorio_Visualizar?cod_primaria=1000193&libro=4260
DYNAMICS:
http://0-www.ingebook.com.lope.unex.es/ib/NPcd/IB_Escritorio_Visualizar?cod_primaria=1000193&libro=4261

2. Morán y Shapiro, Fundamentos de Termodinámica Técnica (Reverté, 2004).

Complementary bibliography

- Galán, Moreno y Reino, Mecánica para ingenieros Manuales UEX 44 (Servicio de Publicaciones de la UEX, 2007)
- Ortega, Lecciones de Física. Mecánica I, II (autoedición, 1989).
- Ramiro, González, Sabio y González, Termodinámica Técnica (UEx, 1994).
- Aguilar Peris, J. Curso de Termodinámica (Alhambra Universidad)
- Çengel-Boles, Termodinámica (McGraw-Hill, 2006), also available at the electronic library site:

  http://0-www.ingebook.com.lope.unex.es/ib/NPcd/IB_Escritorio_Visualizar?cod_primaria=1000193&libro=4274

Other teaching and material resources

1. http://campusvirtual.unex.es
2. http://www.dfists.ua.es/experiencias_de_fisica/index1.html
3. http://www.lawebdefisica.com/
4. http://www.sc.ehu.es/sbweb/fisica/default.htm
5. http://phet.colorado.edu/en/simulations/category/physics
6. http://physicsworld.com/
7. http://www.physics.org/
8. http://acer.forestales.upm.es/basicas/udfisica/asignaturas/fisica/default.htm