Universidad Zaragoza

Academic Year/course: 2021/22

28601 - Physics I: general mecanichs

Syllabus Information

Academic Year: 2021/22
Subject: 28601 - Physics I: general mecanichs
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 422 - Bachelor's Degree in Building Engineering
ECTS: 6.0
Year: 1
Semester: First semester
Subject Type: Basic Education
Module:

1. General information

1.1. Aims of the course

The foreseen outcomes of this subject are based on the following approaches and objectives:

- Comprehension of the concepts and fundamental laws of mechanics, waves and thermodynamics, and their implementation in basic problems arising from the Engineering and Architecture.
- Analysis of problems related to different aspects of the Physics, recognizing the multiple Physics foundations underlying technical implementations, devices and real systems.
- Comprehension of the units of measurements and order of magnitude of the physical magnitudes in use, implementing them in problem solving related to Engineering and Architectural aspects and using the right numerical values with the right units of measurements.
- Correct use of the basic mathematical methods and reasoning for experimental measurements and simulations processing, expressing and interpreting the gathered data and relating them to their appropriate magnitudes and underlying physical laws.
- Correct use of the bibliography available with a critic mind and focus, using a technical language with clear ideas and concepts in order to explain and debate about issues of the underlying Physics and knowledges related to it.
- Correct implementation and use of the multiple equations provided by the Physics under study to fields such as the Civil Enginering and Architecture.
- Comprehension of the meaning, right use and relationship among the multiple physical magnitudes in use.
- Correct use and distinction between temperature and heat, meaning their right implementation in calorimetry problems such as thermal expansion and heat conduction in materials and structures.
- Implementation of the Thermodynamic Principles to different kind of thermal process, basic cycles and heat engines.
- Comprehension, interpretation and correct description of wave phenomena.

1.2. Context and importance of this course in the degree

This subject is part of the basic structure of academic knowledges required for the students to overcome with success this academic degree. It is a compulsory subject being taught in the first semester in the first course with 6 ECTS.

1.3. Recommendations to take this course

It is advisable for the students to have a good knowledge in General Physics and Mathematics equivalent to the curricula given in Secondary Education in the European Union. In outline, students should have knowledges of Linear Algebra, Vector Calculus and Integral and Differential Calculus in Mathematics, and also of physical concepts related to Kinematics, Dynamics, Statics, Fluid Statics, Thermodynamics, Waves and Acoustics in Physics; also, it is highly recommended a good capability and skill in problem solving.

2. Learning goals

2.1. Competences

Those students that have passed this subjecr are going to be more competent to:

Specific competences

CB2: Applied knowlege of the basic principles of general mechanics, static of structural systems and mass geometry.

General competences:

G01: Capacity for organization and planning.

G02: Capacity for problem solving.

G03: Capacity for taking decisions.

G04: Capacity for written and oral communication in their native language.

G05: Capacity for analysis and giving an outline.

G06: Capacity for information management.

G07: Capacity for working as a member of a team.

G08: Capacity for logical and critical reasoning.

G09: Capacity for working as member of an interdisciplinary team.

G10: Capacity for working in an international context.

G11: Capacity for adaptation and improvisation in order to face new situations.

G12: Aptitude for leadership.

G13: Positive social aptitude towards new social and technological innovations.

G14: Capacity for reasoning, debate and exposition of new ideas.

G15: Capacity for comunication throug words and images.

G16: Capacity for seeking, analysis and choice the right information.

G17: Capacity for self-taught learning.

G18: To have and understand knowleges in a study area coming from the Secondary School Education and that are positioned at a level, resting on advanced textbooks, that includes some aspects and knowledges that are at the forefront of their professional study field.

G19: To apply their knowledges to their job or vocation in a professional way having the competencies showed by means of drawing up and defense of arguments and by problem solving in their professional study field.

G20: Capacity for gathering and interpreting relevant data (normally in their professional field).

G21: Sharing information, ideas, problems and solutions, with general and specialized publics with their professional study field.

G22: Developing those skill necessaries to begin high level studies in a self-taught learning and in an autonomous way.

2.2. Learning goals

In order to pass with success this subject, all the enrolled students must show the following results:

- Capability for identifying physical magnitudes from their units of measurements.
- To recognize features of scalar and vector magnitudes.
- Solving practical issues related to kinematics, dynamics and fluids, using concepts from the Differential and Integral Calculus.
- To recognize the kind of forces that take part in static and dynamic systems and their effects.
- Identifying physical magnitudes that remain constant in a system after an interaction.
- Drawing up force equations and momentum in static problems.
- Solving problems of rigid body rotations around a point or an edge.
- Solving practical wave problems using the fundamental concepts and equations of the wave theory.
- To recognize the differente types of wave phenomena.
- Using the first principle of Thermodynamics in order to solve calorimetry problems.
- To describe thermodynamic processes for an ideal gas and comprehend these simple thermodynamic cycles.
- Mastering the fundamental magnitudes used to describe a system in fluid mechanics.
- Taking experimental measurements in the laboratory so as to analyze and debate later the results obtained, presenting them in the right way, both written and oral, justifying the results obtained and their meaning.

2.3. Importance of learning goals

Physical phenomena and their effects are among the most important fields of knowledge with major capacity to intervine in people life and society. The huge amount of physical applications developed since the end of the XIX century has changed substantially people life conditions, economical processes, knowledge management and scientific researches. The handling of the fundamental of such phenomena and the solutions that can be applied in order to use them has become an essential

element in every technological process. The mastering of Physics could help to every Technical Architect to comprehend aspects such as structural stability, hydraulic, among others, based on static and fluid knowledges and other Physics studies.

The contents of this subject are a vital part of the knowledges learnt in this degree, providind students concepts and tools necessaries to face with success other subjects, such as:

Physics II: Structural Statics,

Physics Fundamentals of installations,

Structures I, among others.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

Students must show to have fulfilled the foreseen learning outcomes by means of the following evaluation activities:

Progressive Evaluation System

Those students willing to participate in this evaluation system must attend, at least, at an 80% of the all the presential activities developed in this subject.

This progressive evaluation system consist of the following group activities:

- Individual activities in class.
- Laboratory activities.
- Problems, questions and proposed work.
- Midterm exams.

The following table summarize the marks assigned to each activity mentioned above:

Evaluation Activity	Mark
Individual activity in class	10%
Laboratory activities	15%
Problems, questions and proposed work	15%
Midterm exams	60%

Previously to the first final exam all students are going to get a notification from their Tutor or Lecturer telling them if they have passed or fail this subject from the results obtained in the Progressive Evaluation System, based on the sum of the marks got in the different evaluation activities developed throughout the course and summing each one of them with at least a 5.0 mark. Those student who failed this subject by this evaluation method will have two different resit dates to pass it (Global Evaluation Examinations), whereas, those who have passed this subject by the Progressive Evaluation System, but wish to get a higher mark, can take the first Global Evaluation Exam in order to improve their mark but not to decrease of failed it.

Global Evaluation Examinations

Students must choose this evaluation method when, by their own personal situation, their cannot get used to the work pace required by the Progressive Evaluation System or they have failed or wish to get a higher mark after having participated or not in the Progressive Evaluation System.

In the same way as the Progressive Evaluation System focus on the learning outcomes check, the Global Evaluation Examinations focus on them contribuiting to the acquisition of the several competencies proposed by this subject.

The Global Evaluation Examination consist of the following group of activities:

- **Lab session**: This activities are going to be developed throught the course within the Progressive Evaluation System calendar giving a 15% grade of the final mark of this subject.
- **Practice session**: The Tutor or Lecture will propose practical case problems and theoretical questions to solve individually or in groups in order to hand in them at the date define for this activity. It will give a grade of 15% of the final mark.
- **Written exams**: Consideranding the scientific level of this subject, learned through problem solving and theory comprehension, the exams will consist of a combination of medium level complexity problems, similar to those developed in class, and theoretical questions, with a reasonable answer time of 3.0 hours. The results of theses exams are going to give a grade of 70% de the final mark of this subject.

The following table summarize the marks assigned to each activity mentioned above:

Evaluation Activity	Mark

Lab session	15%
Practice session	15%
Written exam	70%

Students are going to pass this subject based on the sum of the marks obtained in the different activities developed, summing each of them with at least a 5.0 mark.

Those students who have failed the Progressive Evaluation System but have passed some of the activities developed in, leaving out the midterm exams, these passed activities are going to be promoted to the Global Evaluation exams leading to cases in which a student must take only the written exam.

All the activities considered in the Global Evaluation Examination, leaving out the written exams, could be promoted to the second resit date within the current academic course.

The evaluation criteria to give the final mark for the Global Evaluation Examinations are:

- Lab session.
- Pratice session.
- Written exam.

In those unforeseen circumstances in which the Continuous Assessment and its proposed activities can no longer be developed, such as the midterm exams and the laboratory practices, due to well justified motives by the University of Zaragoza or the center, these activities are going to be replaced by:

- Two midterm exams for the Continuous Assessment, and
- Research assignments related to practical applications of this subject for the Laboratory practices.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as theory sessions, practice sessions, laboratory workshops and tutorials.

Strong interaction between the teacher and the student is promoted. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The course "Física I: mecánica general" is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions and laboratory work, at the same time supported by other activities.

Regarding the slides, proposed exercise photocopies, laboratory session guides and other materials used in class, all of them will be available on the Moodle platform of this course or at the Photocopying Service of the centre.

Material	Format
Topic theory notes Topic problems	Paper/repository
Topic theory notes Topic presentations Topic problems Related links	Digital/Moodle E-mail
Educational software	Open source Maxima and Octave

If classroom teaching were not posssible due to health reasons, it would be carried out on-line.

4.2. Learning tasks

This 6 ECTS (150 hours) course is organized as follows:

- **Theory sessions**: (3 ECTS: 30 h). 4h per week. Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the course are displayed, highlighting the fundamental, structuring them in topics and or sections, interrelating them.

- **Practice sessions**: (2 ECTS: 20 h) Problems and practical cases are carried out, complementary to the theoretical concepts studied.
- **Laboratory workshop**: (1 ECTS: 10 h). 2h per week. The lecture group is divided up into various groups, according to the number of registered students, but never with more than 20 students, in order to make up smaller sized groups.
- **Individual Tutorials**: Those carried out giving individual, personalized attention with a teacher from the department. These tutorials may be in person or online.
- **Autonomous work and study** (90 hours).
    - Study and understanding of the theory taught in the lectures.
    - Understanding and assimilation of the problems and practical cases solved in the practical classes.
    - Preparation of seminars, solutions to proposed problems, etc.
    - Preparation of laboratory workshops, preparation of summaries and reports.
    - Preparation of the written tests for continuous assessment and final exams.

4.3. Syllabus

This course is required for physics majors and all students in engineering. It will introduce the concepts and practice of Physics. The topics and tools presented here provide the foundation needed in any engineering course. This course will cover elementary mechanics of particles and rigid bodies, Newton?s laws, work and energy, and conservation of momentum and energy, among others.

The main topics developed here are:

- What is Physics? Measurement and vectors
- Motion in two and three dimensions
- Newton's laws and forces
- Dynamic of a particle and several particles
- System of particles and collisions
- Dynamics of a rigid body
- Statics of particles and rigid bodies
- Fluid statics and dynamics
- Oscillatory motion
- Gravitation
- Waves
- Acoustics
- Resonance
- Thermodynamics

4.4. Course planning and calendar

An estimated timetable of lectures is given below:

1. Units of measurements and vectors. Coordinate systems.
2. Kinematics: distance and displacement, velocity and speed, acceleration.
3. Kinematics: motion in two and three dimensions (linear, parabolic, circular, harmonic, among others).
4. Dynamics of a particle: Newton's laws, forces in nature, particle motion, work, power and energy. Conservation of energy. Stokes' law.
5. System of particles. Conservation of energy and linear momentum.
6. Dynamics of a rigid body: rotation motion, mass moment of inertia, rotational kinetic energy. Conservation of angular momentum.
7. Statics of a particle and a rigid body: centre of gravity, conditions for equilibrium, equilibrium in a accelerated frame.
8. Fluid statics and dynamics: density, pressure, buoyancy and Archimedes' Principle, fluids in motion.
9. Oscillatory motion: simple harmonic motion, energy in simple harmonic motion, damped oscillations, driven oscillations and resonance.
10. Gravitation.
11. Waves and wave phenomena: properties of a wave, equations, superposition, standing waves.
12. Acoustics and resonance: sound waves, the Doppler Effect.
13. Thermodynamics: temperature and thermal equilibrium, temperature scales, the ideal-gas law.
14. Heat and the First Law of Thermodynamics. The internal energy of an ideal gas. Work and the PV diagram for and ideal gas. Thermodynamical processes.

15. The second law of Thermodynamics. Heat engines, refrigerators, the Carnot engine. Applications.
16. Revision activities for the final exam.

Important dates, such as work presentations, laboratory practices, written exams, among other foreseen acitivities will be communicated to the students in the class room or through the Moodle platform a long time in advance.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of EUPLA website and Moodle.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28601