

# Pedagogic case and specific course in which designed tasks and units are used

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<b>Pedagogic case:</b>	<ul style="list-style-type: none"><li>• Inquiry-based for the different topics of Mathematics and its applications in the 1st year of the Program of studies in Mathematics</li></ul>
<b>Description</b> (including temporal scheme for design, development and implementation)	<ul style="list-style-type: none"><li>• The student is introduced in some disciplines of mathematics, with special emphasis on applications in different aspects of science, technology or art.</li><li>• Rough planning:<ul style="list-style-type: none"><li>- design in September 2018,</li><li>- development October 2018 – May 2019,</li><li>- implementation January - May 2019</li></ul></li></ul>

<p><b>Aim of pedagogic case</b></p>	<ul style="list-style-type: none"> <li>• To know and to handle the concepts and basic results of number theory, discrete dynamics, plane and spherical trigonometry, geometry and graph theory.</li> <li>• To relate the mathematical contents and problem solving in some applications in science, culture and technology.</li> </ul>
<p><b>Mathematical concepts</b></p>	<ul style="list-style-type: none"> <li>• Part 1. Number Theory and applications (Control digits, RSA).</li> <li>• Part 2. Geometry (Groups of symmetry) and applications (tessellations, La Alhambra).</li> <li>• Part 3. Plane and spherical trigonometry and applications (Astronomy of position, Navigation, Positioning systems by satellite: GPS, Galileo).</li> <li>• Part 4. Discrete dynamics and applications (Populations, Logistic equation).</li> <li>• Part 5. Graph theory and applications (Classic problems: Konigsberg bridges, traveling problem, Google).</li> </ul>
<p><b>Addressed practice</b></p>	<ul style="list-style-type: none"> <li>• 1<sup>st</sup> year of the Program of studies in Mathematics, including “Mathematics”, “Mathematical Engineering” and “Mathematics and Statistics”</li> </ul>
<p><b>Place in specific course</b> Course name Place of teaching units</p>	<ul style="list-style-type: none"> <li>• The course is called Elements of Mathematics and its applications</li> <li>• The five teaching units described above will be developed throughout the academic year 2018-2019</li> </ul>
<p><b>Learners profile</b> orientation, year, age, prior knowledge, other such as math anxiety, special needs, ..</p>	<ul style="list-style-type: none"> <li>• Students of “Mathematics”, “Mathematical Engineering” and “Mathematics and Statistics”</li> <li>• First year students</li> <li>• Prior knowledge: previous course of basic Mathematics.</li> <li>• Mathematical content is new to all students</li> <li>• Considering different parts of Mathematics, the mathematical tools are presented to the students with the aim of applying them to real and actual problems, giving special importance to the applications.</li> </ul>
<p><b>Organization of specific course</b> study credits/hours, location, group size</p>	<ul style="list-style-type: none"> <li>• 7,5 credit course: 5 ECTS for mathematics part, 2,5 ECTS for applications/ practical part (which is also meant to be inquiry-oriented according to the co-teacher)</li> <li>• Course runs on weekly basis from October 2018 up to and including May 2019 as obligatory course of the 1<sup>st</sup> year.</li> <li>• Number of students: 55 per group (5 groups)</li> </ul>

<p><b>Expected learning outcomes</b></p>	<ul style="list-style-type: none"> <li>• To solve Mathematics problems, through basic calculation skills and other techniques.</li> <li>• To communicate, both in writing and orally, knowledge, procedures, results and mathematical ideas.</li> <li>• To develop the ability to identify and mathematically describe a problem, structure the available information and select an appropriate model.</li> <li>• To know the language and the most elementary applications of some mathematical topics such as number theory, discrete dynamics, plane and spherical trigonometry, geometry and graph theory, as well as problem solving algorithms on these issues.</li> </ul>
<p><b>Envisioned use of digital technology</b></p>	<ul style="list-style-type: none"> <li>• At the present time, it is not contemplated the use of digital technology, but it is scheduled for the 2019-20 academic year to introduce the students in the MAPLE software that covers all the blocks of the course.</li> </ul>
<p><b>Planning of tasks</b></p>	<ul style="list-style-type: none"> <li>• Coordinating the group of professors who teach the course.</li> <li>• Reviewing the text related to the different blocks of the course which was prepared by the Professor who have given this course.</li> <li>• Looking at new texts in the bibliography related to the different blocks of the course.</li> <li>• Elaborating new proposals of different actual and real problems.</li> <li>• Discussing opportunities for student inquiry within the developer's group.</li> <li>• Discussing the first draft within the developer's team.</li> <li>• Discussing opportunities to make the lectures more interactive and inquiry-oriented, and the roles of the mathematical tasks herein.</li> <li>• Setting up the communication with the students.</li> <li>• Drafting the questionnaire about the mathematics part of the course and its applications.</li> </ul>
<p><b>Names of persons involved</b></p>	<ul style="list-style-type: none"> <li>• Prof. Marta Folgueira</li> <li>• All the Professors of the Spanish Platinum Team</li> <li>• Professors who teach the course</li> <li>• Students of the course</li> </ul>
<p><b>Course:</b></p>	<p>Elements of Mathematics and its applications</p>

<p><b>Learning objectives</b></p>	<p>Students learn</p> <ul style="list-style-type: none"> <li>• To apply basic mathematics in different aspects of science, technology or art.</li> <li>• to read and write mathematics at a basic level relevant for science, culture and technology context.</li> </ul>
<p><b>Learning contents</b></p>	<ul style="list-style-type: none"> <li>• Number Theory (Congruences, Fermat's Theorem, Chinese Theorem, <math>Z_n</math>, Simple Diophantine Equations) and applications.</li> <li>• Discrete dynamics (Equations in linear differences of 1st and 2nd order, Bifurcation and chaos) and applications.</li> <li>• Plane and spherical trigonometry (spherical triangles, coordinates in the sphere, reference systems and transformations) and applications.</li> <li>• Geometry (Groups of symmetry and its representation, Transformations, Tessellations) and applications.</li> <li>• Theory of graphics (definitions, Eulerian and Hamiltonian graphics, matrices associated with graphics, ...) and applications.</li> </ul>
<p><b>Teaching /learning activities</b></p>	<ul style="list-style-type: none"> <li>• Course week consists of one 2-hours lecture; one 1-hours practical session (where the group of students are divided into two subgroups of practical tasks).</li> <li>• Tutorials allow students to work on set tasks and discuss them with the lecturer.</li> </ul>
<p><b>Media</b></p>	<ul style="list-style-type: none"> <li>• Tutorials and videos.</li> </ul>
<p><b>Evaluation</b></p>	<ul style="list-style-type: none"> <li>• A percentage in the standard course evaluation.</li> </ul>
<p><b>Instructor role</b></p>	<ul style="list-style-type: none"> <li>• Developing new problems and applications related to the mathematical contents of the course.</li> <li>• Coordinating and working together with professors and instructors.</li> <li>• Working with students in tutorials encouraging their own activity and thinking and providing support.</li> </ul>
<p><b>Student roles</b></p>	<ul style="list-style-type: none"> <li>• Active participation in the lectures.</li> <li>• Active participation on the practical sessions.</li> <li>• Active participation in the lectures on tutorial session.</li> </ul>