Guía docente / *Course Syllabus*

2019-20

1. Descripción de la Asignatura / *Course Description*	
Asignatura *Course*	MATEMÁTICA EMPRESARIAL II (docencia en inglés)
Códigos *Code*	504007; 902010
Facultad *Faculty*	Facultad de Ciencias Empresariales
Grados donde se imparte *Degrees it is part of*	Grado en Administración y Dirección de Empresas (Inglés); Doble Grado en Administración y Dirección de Empresas (Inglés) y Derecho
Módulo al que pertenece *Module it belongs to*	Métodos cuantitativos
Materia a la que pertenece *Subject it belongs to*	Métodos cuantitativos para la empresa
Departamento responsable *Department*	Economía, Métodos Cuantitativos e Historia Económica
Curso *Year*	1º
Semestre *Term*	2º
Créditos totales *Total credits*	6
Carácter *Type of course*	Obligatoria
Idioma de impartición *Course language*	Inglés
Modelo de docencia *Teaching model*	C1

Clases presenciales del modelo de docencia C1 para cada estudiante: 23 horas de enseñanzas básicas (EB), 22 horas de enseñanzas prácticas y de desarrollo (EPD) y 0 horas de actividades dirigidas (AD). Hasta un 10% de la enseñanza presencial puede sustituirse por docencia a distancia (también presencial, pero posiblemente asíncrona), de acuerdo con la programación de la Asignatura publicada antes del comienzo del curso.

Number of classroom teaching hours of C1 teaching model for each student: 23 hours of general teaching (background), 22 hours of theory-into-practice (practical group tutoring and skill development) and 0 hours of guided academic activities. Up to 10% of face-to-face sessions can be substituted by online teaching, in accordance with the course schedule published before it begins.

2. Responsable de la Asignatura / *Course Coordinator*

Nombre *Name*	Ana María Martín Caraballo
Departamento *Departament*	Economía, Métodos Cuantitativos e Historia Económica
Área de conocimiento *Field of knowledge*	Métodos Cuantitativos para la Economía y Empresa
Categoría *Category*	Profesora Colaboradora
Número de despacho *Office number*	3.2.18
Teléfono *Phone*	954978044
Página web *Webpage*	https://www.upo.es/profesorado/ammarcar
Correo electrónico *E-mail*	ammarcar@upo.es

3. Ubicación en el plan formativo / *Academic Context*

Breve descripción de la asignatura *Course description*	Mathematics for Business II is a 6-credit obligatory subject, belonging to the following plans: Business Administration and Management Degree, and Double Degree in Business Administration and Management, and Law. It is taught in the first year of both Degrees, and it depends on the Academic Area of Quantitative Methods in the Department of Economics, Quantitative Methods and Economic History (Departamento de Economía, Métodos Cuantitativos e Historia Económica). From a practical nature and using up-to-date computer tools, various mathematical techniques are introduced in this subject (related to input-output analysis, diagonalizable matrices, quadratic forms classification, convexity of functions and optimization). These techniques will be used both to develop the scientific method and logic reasoning in the student and to deal with success other subjects of their degree.
Objetivos (en términos de resultados del aprendizaje) *Learning objectives*	- To make the student familiar with the daily mathematical vocabulary, and to make him used to a logic reasoning to carry out the resolutions of problems. - To provide students with mathematical knowledge and techniques; these will be useful to complete their higher education and to carry out their professional life. - To supply the student with the basic, indispensable tools from Optimization Theory (or Mathematical Programming) and Input-Output Analysis, so that he may be able to easily interpret and tackle mathematical models associated with the economic problems that can be found in other subjects and in the business world. - To provide a deeper understanding of the computational software program Mathematica, and to facilitate the application of this computational tool for the resolution of problems posed within the course.
Prerrequisitos	There is no previous formal requirement to read this subject.

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Prerequisites	
Recomendaciones *Recommendations*	It is required to have basic knowledge from the Bachillerato and previous years. It would be also useful to have previously passed the course Mathematics for Business I (1st year of Business Administration and Management Degree).
Aportaciones al plan formativo *Contributions to the educational plan*	The role of this course is very important in the degree of GAND (and XAID). On the one hand, this course is rooted in the capacity of student to open different ways of solving and analyzing problems from a range of different fields. On the other hand, the utility of mathematical tools in other subjects of their Curriculum; we want to emphasize the utility of our course in subjects such as: Microeconomía (Microeconomics), Estadística Empresarial I (Businees Statistics I), Estadística Empresarial II (Business Statistics II), Matemática Financiera (Financial Mathematics), Macroeconomía (Macroeconomics), Métodos Estadísticos y Econométricos en la Empresa (Statistical and Econometric Methods for Business), Modelos para la Programación y Planificación Empresarial (Business Programming and Planing Models) and Técnicas Matemáticas de Decisión (Mathematical Techniques for Decision Making). This subject is essentially practical. We want to emphasize the utility of mathematical tools in other subjects of this degree, and we take on importance to the use of up-to-date and suitable computer tools to solve the problems set out in the subject. Additionally, the teaching will focus on providing the student a solid knowledge of the basic aspects which the student can apply, in an autonomous way, other forward-thinking knowledge. In spite of the practical nature of this subject a minimum level of rigor will be establish which will allow the student to develop skills in logic reasoning and in comprehension of formal language and they will result in their training for the labour market.

4. Competencias / *Skills*

Competencias básicas de la Titulación que se desarrollan en la Asignatura *Basic skills of the Degree that are developed in this Course*	CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio CB3 - Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado CB5 - Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía
Competencias generales de la Titulación que se desarrollan en la Asignatura *General skills of the Degree that are developed in this Course*	CGI1 - Capacidad de análisis y síntesis CGI2 - Capacidad de organización y planificación CGI7 - Capacidad para la resolución de problemas. CGI8 - Capacidad para tomar decisiones CGP6 - Capacidad crítica y autocrítica CGP8 - Trabajar en entornos de presión CGS3 - Capacidad de aprendizaje autónomo

	CGS5 - Motivación por la Calidad CGS6 - Capacidad de Adaptación a nuevas situaciones
Competencias transversales de la Titulación que se desarrollan en la Asignatura *Transversal skills of the Degree that are developed in this Course*	CT1 - Comunicación oral y escrita en castellano. CT2 - Comunicación oral y escrita en una lengua extranjera. CT4 - Conocimientos de informática relativos al ámbito de estudio. CT6 - Compromiso ético en el trabajo.
Competencias específicas de la Titulación que se desarrollan en la Asignatura *Specific competences of the Degree that are developed in the Course*	CE19 - Conocer las técnicas matemáticas y estadísticas básicas aplicadas al ámbito económico-empresarial, y analizar cuantitativamente la realidad económico-empresarial e Interrelacionar los conocimientos adquiridos en diversas materias de la titulación en el ámbito matemático, estadístico y de teoría económica
Competencias particulares de la asignatura, no incluidas en la memoria del título *Specific skills of the Course, not included in the Degree's skills*	- Knowledge of basic mathematical techniques in Input-Output Analysis through the Matrix Theory. - To understand and put into practice the different optimization models. - To be able to select and use the appropriate computing techniques in order to resolve such models.

5. Contenidos de la Asignatura: temario / *Course Content: Topics*

TEMA 1	INPUT-OUTPUT ANALYSIS
1.1	Input-Output Production Model. Technical Matrix. Leontief Matrix.
1.2	Input-Output Price Model.
1.3	Productive Matrices: Characterization and Economic Interpretation.
1.4	Autonomous Sets. Fundamental Products.
1.5	Input-Output Analysis in the Andalusian Statistical System.
TEMA 2	MATRICES IN BUSINESS MODELLING
2.1	Eigenvalues and Eigenvectors of a Matrix. Characteristic Equation. Multiplicity.
2.2	Diagonalizable Matrices. Similar Diagonal Matrix and Transformation Matrix.
2.3	Quadratic Forms. Classification.
2.4	Classification of Symmetric Matrices.
2.5	Computational Applications.
TEMA 3	DIFFERENTIABILITY AND CONVEXITY OF REAL-VALUED FUNCTIONS
3.1	Partial Derivatives. Marginal Rate of Technical Substitution.
3.2	Higher-order Partial Derivatives. Hessian Matrix.
3.3	Convex Sets. Convex and Concave Functions.
3.4	Computational Applications.
TEMA 4	OPTIMIZATION THEORY
4.1	Representation of the Problem. Concept of Optimum: Maxima and Minima, Strict and Non-strict Optima, Local (or Relative) and Global Optima. Local-Global Theorem. Weierstrass Theorem.
4.2	Optimization of Real-valued Functions of One Real Variable (Single-variable Optimization).
4.3	Optimization of Real-valued Functions of Several Variables (Multi-variable Optimization) without any Constraints.

	4.4	Optimization with Equality Constraints. Economic Interpretation of Lagrange Multipliers.
	4.5	Computational Applications.

6. Metodología y recursos / *Methodology and Resources*

Metodología general *Methodology*	The teaching of this course will be face-to-face classes, even if the teaching will be supported by the virtual learning platform of the university in order to improve the comunication with students. On-site teaching will consist of a 50% of general theory classes (GT) and a 50% of theory-into-practice classes (PT). Finally, personalized tutorials are optional for students where the can set out specific doubts related to the subject contens.
Enseñanzas básicas (EB) *General teaching*	On-site sessions of 1.5 hours each (one per week) will be set throughout the whole term. These classes will be based on formal lessons taught by the lecturer and their main aim will be to introduce, in a schematic and general way, the main theoretical aspects of every unit. Sessions will be also devoted to solve problems on the blackboard by the lecturer.
Enseñanzas prácticas y de desarrollo (EPD) *Theory-into-practice*	These teachings will be developed throughout on-site sessions, of 1.5 hours each, during the whole term. Lessons will be mainly practical and they will be devoted to solving problems by students. Some of these sessions will be hold in the computers room and directed by the lecturer. The final aim of these special sessions in the computers room (SSC) consists on providing students with the opportunity to learn how to use the symbolic computing software Mathematica so that they will apply it to solve similar problems to those set out during the other sessions. Specific notes about this program will be presented to students prior to SSC taking place, so that students could work on them beforehand.
Actividades académicas dirigidas (AD) *Guided academic activities*	There are not.

7. Criterios generales de evaluación / *Assessment*

Primera convocatoria ordinaria (convocatoria de curso) *First session*	El 50% de la calificación procede de la evaluación continua. El 50% de la calificación procede del examen o prueba final. The ongoing assessment will take up 5 points out of 10 of the final mark in this subject. Throughout the term, several tests and exercises will be carried out to follow student development in the acquisition of competences proposed in the Course. There will be various types of test: - Theoretical knowledge will be tested at the end of each learning module through an on-line, multiple choice questionnaire (with one or more true answers). These exams will be taken through the virtual learning platform on the dates assigned at the time. The total value of these tests will be 1 point. - At the end of each unit, and in the PT session which will be announced, the student will have to solve different exercises corresponding to the unit. These will be corrected and will have a total value of 2 points. - Throughout the term, there will be several computer room sessions (SSC). The use of Mathematica software will be assessed

	within some specific sessions by solving some practical exercises using the computer, as well as practical exercises proposed by the lecturer and related to those given out to students before the computer room sessions. These exercises will have a total value of 2 points. The final exam will make up 5 points out of a total of 10 of the final mark. Theoretical knowledge will be evaluated through short questions and/or through multiple choice questions (penalizing mistakes) with a value of 1.5 points. Practical knowledge will be worth 3.5 points and will be tested by resolving problems. In order to pass the course in the 1st summons, the following minimal marks are needed: - Computer sessions: 1 point out of 2. - Final exam: 1.5 points out of 5. If the minimal marks are reached, the final mark of this course will be the addition of the marks obtained in the written exam and in the ongoing assessment. A total of 5 points is needed to pass this course.
Segunda convocatoria ordinaria (convocatoria de recuperación) *Second session (to re-sit the exam)*	According to Article 8 of the Normativa de Evaluación de los Estudiantes de Grado de la Universidad Pablo de Olavide, de Sevilla, students who failed the course in the 1st session have a second chance of passing it in the resit (2nd session) which will take place within June/July. In this summons, the students will have to take a final exam will have a maximum mark of 5 points (out of 10) and the same characteristics than the first session' final exam. Besides, the mark obtained in the ongoing assessment will also be considered. If the ongoing assessment had not been completed, that is, the student shouldn't obtain the minimum mark in the computer test (1 point out of 2), then, the student will also be tested on them (so, the final exam will include an extra part with a computer test similar to the test done during the semester, and including all the units of the subject. The student has the chance of refusing to his/her mark (independently from his/her result in the computers test), in order to sit an exam with a maximum mark of 10 points. In this specific case, the student will do the final exam and the extra part where they will be assessed of the same skills that them in the ongoing assessment. This extra part will have a maximum mark of 5 points and will consist on a multiple-choice questionaire with one or more right answers in each question (1 point), some additional problems (2 points), and some problems to test the use of Mathematica program (2 points). The decission of refusing to the mark must be notified to the course coordinator (mcmelhir@upo.es) 10 days prior the 2nd summons exam. The student who did not follow the ongoing assessment has to do the final exam in the second summons and the extra part in the same conditions already stated in the previous paragraph. In order to pass the course in the 2nd summons the following minimal marks are needed: - Computer sessions (during the term or within this second summons): 1 point out of 2. - Final exam: 1.5 points out of 5.

	If the minimal marks are reached, the final mark of this course will be the addition of the marks obtained in the final exam, the additional tests performed, and the marks kept from the ongoing assessment if it is the case. A total of 5 points is needed to pass this course.
Convocatoria extraordinaria de noviembre *Extraordinary November session*	Se activa a petición del alumno siempre y cuando éste esté matriculado en todas las asignaturas que le resten para finalizar sus estudios de grado, tal y como establece la Normativa de Progreso y Permanencia de la Universidad. Se evaluará del total de los conocimientos y competencias que figuren en la guía docente del curso anterior, mediante el sistema de prueba única. The evaluation system will be the same that those explained in the second summons for those student that refusing to his/her mark obtained in the ongoing assessment.
Criterios de evaluación de las enseñanzas básicas (EB) *General teaching assessment criteria*	Durante la evaluación continua: it is assessed by virtual exams (with one or multiple choice questions) at the end of each two units and by some parts of the exercises of ongoing assessment. Durante el examen o prueba final (1ª convocatoria): it is assessed through short questions and/or through multiple choice questions (penalizing mistakes) and some parts of the problems of the exam. Durante el examen o prueba final (2ª convocatoria): it is assessed by test questions (penalizing mistakes) and/or short questions and some parts of the problems of the exam. If the student choose the 100% of the mark, it will be necessary to answer a virtual exam (a test with one or more correct answeres) similar to the virtual exams done during the ongoing assessment.
Criterios de evaluación de las enseñanzas prácticas y de desarrollo (EPD) *Theory-into-practice assessment criteria*	Durante la evaluación continua: it is assessed by solving various exercises, by writing exam or using Mathematica software. Durante el examen o prueba final (1ª convocatoria): it is assessed by solving various problems. Durante el examen o prueba final (2ª convocatoria): it is assessed by solving various problems and an exercise to solve using Mathematica software for those students that they had not the minimum mark required in this course or they have chosen the 100% of the mark.
Criterios de evaluación de las actividades académicas dirigidas (AD) *Criteria of assessment of guided academic activities*	Durante la evaluación continua: There are not. Durante el examen o prueba final (1ª convocatoria): There are not. Durante el examen o prueba final (2ª convocatoria): There are not.
Puntuaciones mínimas necesarias para aprobar la Asignatura *Minimum passing grade*	1ª convocatoria: 1 point out of 2 in the computer tests using Mathematica software on the ongoing assessment and 1.5 points out of 5 in the final exam. 2ª convocatoria: 1 point out of 2 in the computer tests using Mathematica software in the ongoing assessment or in this summon and 1.5 points out of 5 in the final exam.
Material permitido *Materials allowed*	When taking exams (either the 'minimal knowledge' or the written exam), students will not be allowed to use reference or support materials, except from those explicitly authorised by the course lecturers. Specifically, mobile phones or any other kind of devices that store, communicate or share information are totally forbidden; its use will imply a failing grade and can bring academic sanctions.
Identificación en los exámenes *Identification during exams*	En cualquier momento de la realización de una prueba de evaluación los profesores podrán requerir la acreditación de la

	identidad de cualquier estudiante, mediante la exhibición de su carnet de estudiante, documento nacional de identidad, pasaporte u otro documento válido a juicio del examinador. Si no lo hiciese, el estudiante podrá continuar la prueba, que será calificada solo si la documentación es presentada en el plazo que el examinador establezca.
Observaciones adicionales *Additional remarks*	

Los estudiantes inmersos en un programa de movilidad o en un programa de deportistas de alto nivel, así como los afectados por razones laborales, de salud graves o por causas de fuerza mayor debidamente acreditadas, tendrán derecho a que en la convocatoria de curso se les evalúe mediante un sistema de evaluación de prueba única. Para ello, deberán comunicar la circunstancia al profesor responsable de la asignatura antes del fin del periodo docencia presencial.

Students enrolled in a mobility program or a program for high-level athletes, as well as students affected by work or serious health problems or reasons of force majeure duly accredited, will have the right to be evaluated during the first session through a single test evaluation system. To do this, they must report changes in their circumstances to the program coordinator before the end of the teaching period.

8. Bibliografía / *Bibliography*

GENERAL READING	- FEDRIANI, E.M.; MELGAR, M.C. (2010) "Matemáticas para el éxito empresarial", *Pirámide* - LARSON, R.E.; HOSTETLER, R.P; EDWARDS, B.H. (1986) "Calculus with Analytic Geometry", *McGraw-Hill. London*
PREREQUISITES	- LARSON, R; HOSTERLER, R.P. (2005) "Algebra for College Students", *Houghton Mifflin Company* - WEISSTEIN, E.W. (2002) "CRC Concise Encyclopaedia of Mathematics. 2nd edition", *Chapman & Hall/CRC*
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