Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	**Mathematics for PPE (modular)**
Course code	27042
Scientific sector	SECS-S/06
Degree	Bachelor in Economics and Social Sciences
Semester and academic year	M1: 1st semester 2017-2018 M2: 2nd semester 2017-2018
Year	1
Credits	12 (6+6)
Modular	Yes

Total lecturing hours	M1: 36 hours M2: 36 hours
Total lab hours	---
Total exercise hours	M1: 24 hours M2: 30 hours (12 hours Y. Kaniovskyi + 18 hour P. Maraner)
Attendance	Suggested, but not required
Prerequisites	not requested; the preparatory course "Mathematics" is recommended
Course page	https://www.unibz.it/it/faculties/economics-management/bachelor-economics-social-sciences/

Specific educational objectives	The course refers to the basic educational activities and belongs to the scientific area of statistics-mathematics. (quantitative methods for decision-making). The course gives a general overview of scientific content in mathematics and is designed to acquire skills for the solution of basic mathematical tasks as well as for modeling economical systems. The first module is the first part of an introductory course which covers basics in mathematical language (sets, relations, functions) as well as one-variable calculus. The course is intended as a first step in providing students with solid mathematical foundations to be of use in modeling economical systems, in market research and in the analysis of consumer behaviour.The students will be provided with the basic facts needed to follow modern courses in economics, business and administration. The focus is on understanding the mathematical problems and ideas for their solutions. Solution procedures for several standard problems (for example, find a limit, a derivative, the equation of a tangent to a function and an indefinite integral) will be introduced. The course is aimed at generating familiarity with and proficiency in applying these solution procedures. A graphical approach is chosen if possible, and many (economical) examples will be discussed.

	The second part comprises intermediate mathematical tools necessary to understand and analyze economic mechanisms through theoretical and empirical models described by functions of several variables. Particular educational objectives include: understanding of comparative static analysis in cost/utility optimization by using implicit functions, unconstrained settings and the constrained formulations (the Lagrangian method and the Kuhn – Tucker method).

Module 1	**Mathematics A for PPE (M1)**
Lecturer	Carola Schrage Office E 202 Carola.Schrage@unibz.it Tel. 0471 013284 https://www.unibz.it/it/faculties/economics-management/academic-staff/person/34564-carola-schrage
Scientific sector of the lecturer	SECS-S/06
Teaching language	English
Office hours	Cockpit – students' zone – individual timetable Webpage: https://www.unibz.it/en/timetable/?department=26&degree=12833
Lecturing assistant	--
Teaching assistant	--
Office hours	--
List of topics covered	1. Basic mathematical concepts: • sets (basic operations with sets such as intersection, union, complements, set difference) • relations and their properties (binary, reflexivity, transitivity, totalness etc) • functions as special relations • numbers (intervals, convex combinations of numbers, absolute value) • limits 2. Functions of one variable: basic properties and derivatives, • Domain, range, image and pre-image space, graph of a function • Convexity, concavity, linearity, monotonicity, polynomial functions, inverse functions, homogeneity • First and second derivative • Rules for computing derivatives 3. Polynomial approximation and Newton's method • Taylor approximation of first and second order • The intermediate value theorem and Newton's method to approximate a root of a given function 4. Single-variable optimization • Definition of local/global extrema • Stationary points • First and second order necessary and sufficient conditions for local extrema

	• Extrema under convexity/concavity assumption 5. Integration of single variable functions: • Integration as inverse operation to taking the derivative • Basic rules and the indefinite integral • Areas and definite integrals • Improper integrals
Teaching format	Frontal lessons and exercises.

Module 2	**Mathematics B for PPE (M2)**
Lecturer	Yuriy Kaniovskyi Office E 505 Yuriy.Kaniovskyi@unibz.it Tel. 0471013150 https://www.unibz.it/it/faculties/economics-management/academic-staff/person/86-yuriy-kaniovskyi
Scientific sector of the lecturer	SECS-S/06
Teaching language	English
Office hours	Cockpit – students' zone – individual timetable Webpage: https://www.unibz.it/en/timetable/?department=26&degree=12833
Lecturing assistant	Paolo Maraner PMaraner@unibz.it https://www.unibz.it/it/faculties/economics-management/academic-staff/person/12920-paolo-maraner
Teaching assistant	--
Office hours	--
List of topics covered	Functions of two variables: continuity, partial derivatives, directional derivatives, total derivative, linear and quadratic approximations, tangent plane, convexity in terms of second derivatives, homogeneity. A Cobb-Douglas production function. Linear algebra: vectors, scalar product, linear combinations, matrix operations, transpose, inverse, definiteness of a matrix, equation of a plane. Cramer's rule for systems of two equations with two unknowns and its geometric interpretation. Convex sets and cones in the Cartesian plane. Implicit function and its first derivative, tangent at a points of a level curve. Unconstrained and constrained two-variable optimisation. Necessary and sufficient conditions for an unconstrained extreme point. The Lagrangian method. Nonlinear programming and Kuhn – Tucker theory.
Teaching format	Frontal lectures and exercises.

Learning outcomes	Knowledge and understanding *Mathematics A for PPE (M1):*

- Knowledge and understanding of basic mathematical concepts: sets and set operations, relations and their properties, general functions, numbers and elementary equations/inequalities.
- Knowledge and understanding of functions of one variable: limits, continuity, derivatives and their calculus.
- Knowledge and understanding of single-variable optimization problems: optimality notions and conditions.
- Knowledge and understanding of the mathematical lexicon in English.

Mathematics B for PPE (M2):
Students acquire knowledge of basic mathematical tools specific to economic anylisis. This bulk builds upon their general secondary education and the Mathematics A for PPE part. Through considering classical examples (like Cobb – Douglas production function) students learn to understand the interrelations between different topics of the couse and their relevance to disciplines in economics and management. More specifically Mathematics B for PPE comprises intermediate mathematical tools necessary to understand and analyze economic mechanisms through theoretical and empirical models described by functions of several variables. Particular learning outcomes include: understanding of comparative static analysis, use of the Lagrangian method in cost/utility optimization.

Applying knowledge and understanding
Mathematics A for PPE (M1):

- Understanding of the basic facts needed to follow modern courses in economics, business and administration.
- Understanding mathematical problems and models.
- Ability to differentiate real functions, ability to solve single-variable optimization problems.
- Ability to define economic problems in a formalized approach; to find (optimal) solutions and to interpret results, being informed by existing theories.

Mathematics B for PPE (M2):
Mastering intermediate mathematical tools in analyzing behaviour of economic agents, from both theoretical and empirical points of view. Ability to formalize simple economic problems through mathematical models, to find solutions and to interpret them.

Making judgments
Mathematics A for PPE (M1):

	• Ability to make informed judgments about the relevance of sets vs. relations vs. functions in economical models • Ability to interpret results obtained for single-variable mathematical models for economical systems *Mathematics B for PPE (M2):* Within the scope of mathematical modelling, students learn to explain the outcome in terms of the corresponding social, scientific or ethical issues. Communication skills *Mathematics A for PPE (M1):* • Basic understanding of fundamental mathematical language • Understanding of and ability to communicate ideas, problems and solutions for mathematical models involving real functions *Mathematics B for PPE (M2):* The course provides skills necessary for a presentation of ideas, problems and solutions based on the acquired mathematical skills to both specialist and non-specialist audiences. Ability to read, write and communicate in the technical language of quantitative methods in English. Learning skills *Mathematics Afor PPE (M1):* • Develop skills for the study of basic mathematical structures in an economical environment • Develop skills for the solution of basic mathematical problems related to economical models *Mathematics B for PPE (M2):* Ability to apply calculus in analysing the behaviour of economic agents through both normative and descriptive models.

Assessment	Two partial exams, one covering the M1 part, one covering M2, each counting 50% of the final grade.
Assessment language	English
Evaluation criteria and criteria for awarding marks	*Mathematics A for PPE (M1):* Seven assignments throughout the semester and a two-hour partial exam. Non-attending students may hand in the assignements online. Each completed assignment is worth 0.5 bonus points for the M1 partial exam. The results of assignments and the M1 partial exam are

	only valid for the academic year in which these activities have taken place and results of these activities cannot be carried over beyond that time frame. Students who need only the M1 exam need to obtain 18 out of 30 points in order to pass. *Mathematics B for PPE (M2):* A two-hour partial exam. *Total grade for the course:* 50% grade for M1, 50% for M2. The grades of M1 and M2 parts are only valid for the academic year in question. They cannot be carried over beyond that time frame. *Within each official exam sessions, both partial exams will be held in one day but in separate time slots, M1 in the first one, M2 in the second.* *Registration is automatically valid for both partial exams, but a student may choose to take part in just one exam per session, the second one counting as 0 points.* *An extra 'free shot' is offered at the end of the first module, covering the M1 part, only. No registration is possible or necessary for this partial exam.* *For each partial exam, the best result achieved over the academic cycle will be counted for the final grade.* *For example, if a student does 15pt in M1, 17pt in M2 in May and 18pt in M1, 14pt in M2 in September, then the grade is (18+17)/2= 17.5, thus 18pt as final grade. Especially, the exam is passed, even though the student did not achieve 18 points in M2 and did not pass within either single session.*

Required readings	K. Sydsaeter and P.J. Hammond – Mathematics for Economic Analysis, Prentice Hall, 1995. Other editions of variants of this book (given in the syllabus), under slightly different titles, are suitable as well.
Supplementary readings	*Mathematics A for PPE (M1):* Will be announced in due course if necessary. *Mathematics B for PPE (M2):* Not needed.