

Syllabus

Course Description

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| Course Title | Mathematics for EPE |
| Course Code | 27279 |
| Course Title Additional | |
| Scientific-Disciplinary Sector | |
| Language | English |
| Degree Course | Bachelor in Economics, Politics and Ethics |
| Other Degree Courses (Loaned) | |
| Lecturers | dr. Luciano Marzufero, Luciano.Marzufero@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/49853 Prof. Dr. Martin Meier, Martin.Meier@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/50913 Dr. Paolo Maraner, PMaraner@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/12920 |
| Teaching Assistant | |
| Semester | All semesters |
| Course Year/s | 1 |
| CP | 12 |
| Teaching Hours | 72 (36 + 36) |
| Lab Hours | 72 (36 + 36) |
| Individual Study Hours | - |
| Planned Office Hours | 36 (18 + 18) |
| Contents Summary | Mathematics A This course introduces the fundamental concepts of mathematical analysis, starting from the basic language of sets, functions, and |

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| | <p>numbers. It develops tools for the study of single-variable functions, including limits, derivatives, Taylor expansions, and other properties. Optimization in one dimension and basic notions of convexity are also covered, together with an introduction to integral calculus.</p> <p>Mathematics B</p> <p>This course builds on the foundations of Mathematics A and extends them to multivariable contexts. It covers linear algebra techniques and the study of functions of several variables, including gradients and other properties. Topics also include convexity/concavity and optimization methods, with special emphasis on the Lagrange method and applications in economics. Time permitting, a short introduction to probability theory is provided.</p> |
| Course Topics | <p>MATHEMATICS A:</p> <ol style="list-style-type: none"> 1. Basic mathematical concepts: sets, relations, functions, numbers, limits, absolute values. 2. Functions of one variable: basic properties, derivatives and their calculus, Taylor approximations, Newton's method. 3. Convexity and single-variable optimization (Fermat's rule and sufficient optimality conditions). 4. Elements of integration (indefinite, definite and improper). <p>MATHEMATICS B:</p> <ol style="list-style-type: none"> 1. Matrix calculus, rank and linear independence, systems of linear equations, Gaussian elimination, applications. 2. Functions of several variables: gradients, Hesse matrices, Taylor approximation, convexity and concavity. 3. Multivariable optimization, Lagrange method and economic applications. 4. If enough time remains: Basics of probability theory. |
| Keywords | sets; relations; functions; limits; derivatives; Taylor approximations; Newton's method; optimization; integration; |

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| | matrix calculus; system of linear equations; Gaussian elimination method; gradients; multivariable optimization; Lagrange method. |
| Recommended Prerequisites | |
| Propaedeutic Courses | None |
| Teaching Format | Lectures and exercise sessions |
| Mandatory Attendance | Suggested, but not mandatory |
| Specific Educational Objectives and Learning Outcomes | <p>ILO (Intended Learning Outcomes) - M-1 Mathematics A for EPE</p> <p>ILO 1 Knowledge and understanding</p> <p>ILO 1.1 knowledge of mathematical techniques for solving optimisation problems;</p> <p>ILO 1.2 knowledge of the technical vocabulary of the subjects of this learning area;</p> <p>ILO 2 Applying knowledge and understanding:</p> <p>ILO 2.1 ability to calculate derivatives and partial derivatives;</p> <p>ILO 2.2 ability to calculate limits and sums of series;</p> <p>ILO 2.3 ability to use quantitative methods to solve problems in economics;</p> <p>ILO 2.4 ability to read, write and communicate in the technical language of quantitative methods in the three official languages of instruction;</p> <p>ILO 3 Autonomy of judgement</p> <p>ILO 3.1 Acquisition of the ability to judge and of the methodological tools useful for the critical analysis of data, sources, assumptions and implications of scientific practice, of the political, ethical and legal context within which economic phenomena are set and with which they interact</p> <p>ILO 4 Communication skills</p> <p>ILO 4.1 Proficiency (oral and written) in Italian, German and English, including translation between these languages.</p> <p>Intercultural competence. Conceptual awareness, synthesis and written expression, in particular in the drafting of scientific or science-based documents</p> |

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| | <p>ILO 5 Learning skills</p> <p>ILO 5.1 Promotion of critical thinking and analytical skills to focus on complex problems in their long-term dynamics and the variety of their implications, including ethical ones</p> |
| | <p>ILO (Intended Learning Outcomes) - M-2 Mathematics B for EPE</p> <p>ILO 1 Knowledge and understanding</p> <p>ILO 1.1 knowledge of mathematical techniques for solving optimisation problems;</p> <p>ILO 1.2 knowledge of probabilistic and inferential tools for using statistical models;</p> <p>ILO 1.3 knowledge of the technical vocabulary of the subjects of this learning area.</p> |
| | <p>ILO 2 Applying knowledge and understanding:</p> <p>ILO 2.1 ability to calculate derivatives and partial derivatives;</p> <p>ILO 2.2 ability to calculate limits and sums of series;</p> <p>ILO 2.3 ability to use quantitative methods to solve problems in economics;</p> <p>ILO 2.4 ability to read, write and communicate in the technical language of quantitative methods in the three official languages of instruction;</p> |
| | <p>ILO 3 Autonomy of judgement</p> <p>ILO 3.1 Acquisition of the ability to judge and of the methodological tools useful for the critical analysis of data, sources, assumptions and implications of scientific practice, of the political, ethical and legal context within which economic phenomena are set and with which they interact</p> |
| | <p>ILO 4 Communication skills</p> <p>ILO 4.1 Proficiency (oral and written) in Italian, German and</p> |

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| | <p>English, including translation between these languages.</p> <p>Intercultural competence. Conceptual awareness, synthesis and written expression, in particular in the drafting of scientific or science-based documents</p> <p>ILO 5 Learning skills</p> <p>ILO 5.1 Promotion of critical thinking and analytical skills to focus on complex problems in their long-term dynamics and the variety of their implications, including ethical ones</p> |
| Specific Educational Objectives and Learning Outcomes (additional info.) | |
| Assessment | <p>A written final exam (questions and problems to solve) covering both M1 and M2 parts (M1 partial exam and M2 partial exam, respectively).</p> <p>Written exam of maximal 120min at the end of each module. There is no different assessment for attending and non-attending students.</p> |
| Evaluation Criteria | <p>Final grade: 50% grade for M1 partial exam, 50% for M2 partial exam. The grades of partial exams are only valid for the academic year in question. They cannot be carried over beyond that time frame.</p> |
| Required Readings | <ul style="list-style-type: none"> • Lecture notes provided in due course (available in the Reserve Collection) • L. Peccati, S. Salsa, A. Squellati, "Mathematics for Economics and Business", Bocconi University Press, 2016. • Further readings will be announced at the beginning of the course. |
| Supplementary Readings | |
| Further Information | |
| Sustainable Development Goals (SDGs) | Partnerships for the goals, Quality education |

Course Module

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| Course Constituent Title | Mathematics A for EPE |
| Course Code | 27279A |

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| Scientific-Disciplinary Sector | STAT-04/A |
| Language | English |
| Lecturers | Prof. Dr. Martin Meier, Martin.Meier@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/50913 dr. Luciano Marzufero, Luciano.Marzufero@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/49853 |
| Teaching Assistant | |
| Semester | First semester |
| CP | 6 |
| Responsible Lecturer | |
| Teaching Hours | 36 |
| Lab Hours | 36 |
| Individual Study Hours | - |
| Planned Office Hours | 18 |
| Contents Summary | <p>This course introduces the fundamental concepts of mathematical analysis, starting from the basic language of sets, functions, and numbers. It develops tools for the study of single-variable functions, including limits, derivatives, Taylor expansions, and other properties. Optimization in one dimension and basic notions of convexity are also covered, together with an introduction to integral calculus.</p> |
| Course Topics | <p>MATHEMATICS A for EPE:</p> <ol style="list-style-type: none"> 1. Basic mathematical concepts: sets, relations, functions, numbers, limits, absolute values. 2. Functions of one variable: basic properties, derivatives and their calculus, Taylor approximations, Newton's method. 3. Convexity and single-variable optimization (Fermat's rule and sufficient optimality conditions). 4. Elements of integration (indefinite, definite and improper). |
| Teaching Format | Lectures and exercise sessions |

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| Required Readings | <p>Lecture notes provided in due course (available in the Reserve Collection)</p> <p>L. Peccati, S. Salsa, A. Squellati, Mathematics for Economics and Business, Bocconi University Press, 2016.</p> |
| Supplementary Readings | |

Course Module

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|---------------------------------------|--|
| Course Constituent Title | Mathematics B for EPE |
| Course Code | 27279B |
| Scientific-Disciplinary Sector | STAT-04/A |
| Language | English |
| Lecturers | <p>Dr. Paolo Maraner, PMaraner@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/12920</p> <p>Prof. Dr. Martin Meier, Martin.Meier@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/50913</p> |
| Teaching Assistant | |
| Semester | Second semester |
| CP | 6 |
| Responsible Lecturer | |
| Teaching Hours | 36 |
| Lab Hours | - |
| Individual Study Hours | - |
| Planned Office Hours | 18 |
| Contents Summary | <p>This course builds on the foundations of Mathematics A and extends them to multivariable contexts. It covers linear algebra techniques and the study of functions of several variables, including gradients and other properties. Topics also include convexity/concavity and optimization methods, with special emphasis on the Lagrange method and applications in economics. Time permitting, a short introduction to probability theory is provided.</p> |

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| Course Topics | <ol style="list-style-type: none">1. Matrix calculus, rank and linear independence, systems of linear equations, Gaussian elimination, applications.2. Functions of several variables: gradients, Hesse matrices, Taylor approximation, convexity and concavity.3. Multivariable optimization, Lagrange method and economic applications.4. If enough time remains: Basics of probability theory. |
| Teaching Format | Lectures and exercise sessions. |
| Required Readings | Lecture notes provided in due course (available in the Reserve Collection) |
| Supplementary Readings | |