Quantitative Methods

General data

ECTS credits:	*7*
Semester:	*Fall*
Course restrictions:	*The course builds on the solid knowledge of high-school Mathematics. For those students who do not possess this knowledge, successful completion of the course Introduction to Quantitative Methods is highly recommended.*
Course leader (with availabilities):	*Gyöngyi Bugár, bugar.gyongyi@ktk.pte.hu, +36 72 501 599/ ext. 63289*
Further lecturer(s) (with availabilities):	*Dóra Longauer, longauer.dora@ktk.pte.hu, +36 72 501 599/ ext. 23142*

1. Description and aims

The module aims to make students aware of the usefulness of Mathematics as an aid in formulating and solving business-related problems. It is intended to enable the students to understand the main features of deterministic phenomena and investigate their models as well as to provide a toolkit to other subjects which use mathematical techniques, e.g. Economics, Finance, Operations Research and Operations Management.

2. Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, students should be able to

1. understand and appreciate the key aspects of function theory, optimisation theory and matrix algebra (PILO1)
2. demonstrate the role and significance of quantitative methods in decision making (PILO2)
3. distinguish the limitations of the different optimisation models and solution methods (PILO4)
4. examine and model deterministic phenomena from Business, Economics, Finance, etc. (PILO3)
5. develop and solve simple business-related optimisation problems (PILO3)
6. analyse and interpret the output given by Excel applications (PILO4)

The remarks in brackets express each CILO's connection to the Program Intended Learning Outcomes (PILOs).

3. Content, schedule

The course material will cover the topics as follows.

1. Refresh Your High School Knowledge: Basic Concepts of Mathematics
2. Elementary Theory of Matrices: Matrix Operations, Determinants, Cramer's Rule
3. Business Application of Functions and the Foundations of Linear and Nonlinear Programming
4. Introduction to Calculus: Limit and Convergence of Sequences, Continuity and Limit of Functions
5. Introduction to Differential Calculus: Basic Concepts and Calculus Rules

6. Applications of the Derivative: Complete Analysis of One-Variable Functions
7. Optimisation of Multivariable Functions
8. Integration of One-Variable Functions
9. Solving Systems of Linear Equations: The Pivot Algorithm
10. Applications of the Pivot Algorithm: Matrix Inversion and the Leontief Model
11. Equality-Constrained Optimisation: The Method of Elimination and the Method of Lagrange Multipliers

4. Learning and teaching strategy, methodology

There will be weakly lectures (2 hrs/week) and seminars (2 hrs/week). Exercises and business-related problems will be set as the basis for discussion. For all exercises worked answers will be provided after the relevant seminar in order to guide students to check their own solution and help them identify their mistakes as well as the missing gaps in their knowledge. The solutions will be supported by Excel applications wherever it is possible. All exams will be organised digitally in a computer room (for each student a unique set of exercises will be generated).

5. Assessment

Formative assessment elements

Formative feedback will be provided throughout this module through the discussion of problems given as homework.

Summative assessment elements

Name of the element	Weight	Type	Details	Retake opportunity	Req.*	Related CILOs
Midterm 1	15%	exam	A digital exam based on the material of the first 6 weeks, 4 problems to be solved	coursework retake**	no	1,5
Midterm 2	15%	exam	A digital exam based on the material of 7-11 weeks, 4 problems to be solved	coursework retake**	no	1,2,5,6
Final exam	70%	exam	A digital exam covering the material for the whole semester, 4 problems to be solved	two retake opportunities	yes	1,2,3,4, 5,6

** Req.: Completion of the element is required to pass the course, irrespective of the performance in other elements.*

*** There is no separate retake for midterm exams. Coursework retake covers the material of both midterms, i.e. the material of 1-11 weeks. It is offered only for those students who have not achieved at least 50% of all scores considering the performance in Midterm 1 along with Midterm 2.*

6. Learning materials

Core learning materials

- Gy. Bugár and D. Longauer: Essentials of Business Mathematics – Practice Problems with Step-by-Step Solutions, 2025.
- K. Sydsæter, P. Hammond and A. Strøm: Essential Mathematics for Economic Analysis, Pearson Education, 4th edition, 2012.

Optional learning material

- E. F. Haeussler, R. S. Paul and R. J. Wood: Introductory Mathematical Analysis for Business, Economics and Life and Social Sciences, Pearson Education, Thirteenth edition, 2011.

7. Further information

This course falls under Position 1 of the faculty guidelines on artificial intelligence. Accordingly, the use of AI tools is not permitted when completing assignments. This means that generative AI tools cannot be used in the preparation or completion of formative or summative assessment elements, and the use of generative AI constitutes a breach of academic duty. The use of AI tools for language and spelling checks is not subject to the total ban under Position 1.