QUANTITATIVE METHODS

General data

Course code:	B19GMK03E
ECTS credits:	7
Type of the course:	core course
Semester:	Fall, Semester 1
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. Brief review of the basic concepts of Mathematics: introduction to the theory of sets, numbers, vectors and functions. Operations with sets, numbers and vectors. (ppt QM1)
2. Elementary theory of matrices, matrix operations. Determinants, Cramer's Rule. Business applications. Excel applications for matrix operations. (ppt QM2)

3. Elementary theory of single variable real functions. Continuity, monotonicity, convexity/concavity, extremal values, zeroes, etc. Graphical representation and graphical analysis of single variable real functions. Business applications. (ppt QM3)
4. Elementary theory of two variable real functions. The level curve method. The elements of linear and nonlinear programming. Graphical solution methods. Business applications. (ppt QM4)
5. Introduction to differential calculus. Basic concepts and calculus rules. (ppt QM5)
6. Complete analysis of single variable functions. Business applications. (ppt QM6)
7. Differential calculus for functions with several variables. Seeking for extremum. Business applications. (ppt QM7)
8. The indefinite integral, basic rules for integration. Business applications. (ppt QM8)
9. The definite integral and its geometric meaning. The Newton-Leibniz Rule. Improper integrals. (ppt QM9)
10. Vector space and coordinate transformation methods. The pivot algorithm. Systems of linear equations. (ppt QM10)
11. The inverse of a matrix. Matrix equations. Excel applications for supporting the solution. (ppt QM11)
12. Constrained optimization. Equality constrained optimization problems. The Lagrangian Multiplier Rule. (ppt QM12)

4. Learning and teaching strategy, methodology

Principal teaching methodologies: lectures, in-class discussions, quizzes

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:

Individual Assessment	100%	**Group Assessment**	0%

Name of the element	**Weight**	**Type**	**Details**	**Retake opportunity**	**Req.***	**Related CILOs**
Midterm 1	15%	individual written 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%	individual written 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%	individual written exam	A digital exam covering the material for the whole semester, 4 problems to be solved	one retake opportunity	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

- Essential
  - Handouts (ppt files of lectures and worked answers in pdf files) provided by the lecturers.
  - K. Sydsæter, P. Hammond and A. Strøm: Essential Mathematics for Economic Analysis, Pearson Education, 4th edition, 2012.

- Recommended
  - 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

International aspects embedded with the course
Not relevant to this course.
Ethics, Responsibility & Sustainability (ERS) aspects embedded with the course
Not relevant to this course.
Connections to the world of practice of the course
Not relevant to this course.