

MATHEMATICS IN ECONOMICS – Syllabus and General Information

5 CREDITS, SUMMER SEMESTER

Aim of the course:

The course Mathematics in economics in master's study programme follows the course Quantitative methods in bachelor's study programme. It makes the participants acquainted with further knowledge and methods of differential and integral calculus, and the introduction to differential equations including their application in economics. The aim of the course is to cultivate approach to problem solution particularly in a variety of economic branches and to enable insight into their essence.

Requirements

70% attendance at the seminars, two tests (for 30 points and 70 points). Form of the exam: written.

Content

1. Function of one variable
2. Introduction to differential calculus of one real variable
3. Course of a function of one real variable
4. Function of two variables
5. Local and bounded extremes of a function of two variables
6. Indefinite integral of one real variable
7. Special substitutions in the indefinite integral
8. Definite integral of one real variable
9. Applications of the definite integral
10. Infinite number series
11. Infinite function series
12. Introduction into ordinary differential equations
13. Linear differential equations

1. Functions of one real variable

Algebraic functions, transcendent functions, polynomials, decomposition of a polynomial into product of its roots. Economic applications: supply, demand, equilibrium under perfect competition..

2. The introduction to differential calculus of one real variable

Difference, derivative, differential. Taylor theorem, Taylor and Maclaurin polynomials. Economic applications: rate of a change of a function, function elasticity, substitution of a function by a polynomial of the n-th degree, marginal costs, marginal revenues, minimization of average costs, maximization of total revenue, maximization of profit.

3. The course of a function of one real variable

Economic applications: function of total, average and marginal costs and revenues, minimization of costs, maximization of revenue and profit, relationship between average costs and marginal costs under perfect competition..

4. The function of two real variables

Domain of a function of two real variables, partial derivatives, total differential of the first and second order, tangent plane.

5. Local and bounded extremes of a function of two variables

Weierstrass extrem value theorem, the method of Lagrange multipliers, Economic applications: Cobb-Douglas production function, maximization of revenue and profit, minimization of costs under perfect competition.

6. Indefinite integral of one real variable

Method per partes, substitution, integration of partial fractions. Economic applications: total costs and total revenues.

7. Special substitutions in the indefinite integral

Integration of rational, exponential, logarithmic and goniometric functions.

8. Definite integral of one real variable

Riemann integral, Newton-Leibniz formula, improper integral.

9. . Applications of the definite integral

Calculation of area of regions and volume of solids. Economic applications: consumer and producer surplus under perfect competition.

10. Infinite number series

Infinite number series and their convergence. Limiting criteria and integral criterion of convergence of positive infinite series. Alternating series.

11. Infinite function series

Geometric and power function series, Taylor series. Convergence of series.

12. Introduction into ordinary differential equations

General and particular integral, separation of variables.

13. Linear differential equations

Linear differential equations of the first order, homogenous differential equations.

Literature:

- BRADLEY, T., PATTON, P. *Essentials Mathematics for Economics and Business*. West Sussex: John Wiley & Sons Ltd, 1998. ISBN 0-471-97511-7.
- CHIANG, C.C. *Fundamental Methods of Mathematical Economics*. New York: McGraw-Hill, Inc., 2000. ISBN 0-12-417890-1.

