APPLIES TO ACADEMIC YEAR 2015/2016

ELE 3776 Mathematical Analysis

Programme
Elective

Responsible for the course
Robert Hansen

Department
Department of Economics

Term
According to study plan

ECTS Credits
7,5

Language of instruction
Norwegian

Introduction
Mathematical analysis is an advanced math course that is based on the first-year course in mathematics.

Learning outcome
Acquired Knowledge
The course deepens and extends mathematical analysis techniques from the basic course in the first year. In this context, emphasis is on functional analysis of both the single and the multivariable case. In the multivariable case various techniques for constrained optimization will be examined, also for the case when the constrained condition is given by inequalities. The course also examines selected topics in linear algebra, where students learn vector and matrix arithmetic, Gaussian elimination, determinants, Cramer's rule and matrix inversion. The course also discusses various integration techniques such as partial integration and integration by substitution. Techniques for the solution of simple first order differential equations will also be reviewed.

Acquired Skills
After completing the course the student will have acquired skills and training in calculus and linear algebra that can be used in secondary economics courses at the final bachelor's and master's level. The course also aims to train students in the construction and analysis of simple economic models. In addition, students will gain a deeper understanding of mathematical concepts through the ability to solve more sophisticated mathematical problems than in the freshman course, and furthermore improve the ability of formal and analytical solution of various problems. Specifically, the students will be trained in using techniques from optimization theory to formulate and solve multivariable optimization problems, both purely theoretical problems, and applied problems in economics. From integration theory and solution of differential equations, students will be able to formulate and solve dynamic models, for example in application of economic theory. Using knowledge of linear algebra, students will be able to formulate and solve linear equations in a compact and efficient manner. Students will also get trained in how to transform a non-linear model to a linear model, and to choose the solution technique that is most appropriate to solve a given problem. Generally, students develop skills in being able to understand mathematical problems and choose appropriate strategies to solve them.

Reflection
The course will strengthen the students' ability of analytical thinking and ability to reflect on the results and calculations.

Prerequisites
EXC 2910 Mathematics or equivalent.

Compulsory reading
Books:
Sydsæter, Knut and Peter Hammond. 2012. Essential mathematics for economic analysis. 4th ed. Pearson Education. Utvalgte deler, se kursbeskrivelsen

Recommended reading

Course outline
Chapter references to Sydsæter et. al:

1. Multivariable optimization problems for functions of several variables	Ch. 13.1 - 13.6
2. Constrained optimization (general Lagrange problems)	Ch. 14.1-14.4, 14.6, 14.7
3. Implicit differentiation	Ch. 7.1,7.2, 12.1-12.3

4. Linear and polynomial approximations. Differentials	Ch. 7.4, 7.5, 12.8, 12.9
5. Elasticity	Ch. 7,7, 11.8
6. Homogeneous functions	Ch. 12.6
7. Non-linear programming	Ch. 14.8, 14.9
8. Systems of equations	Ch. 12.10, 15.1
9. Gaussian elimination	Ch. 15.6
10. Matrix and vector algebra	Ch. 15.1 - 15.5, 15.7
11. Determinants and inverse matrices	Ch. 16.1 - 16.8
12. Integration: Integration by parts and integration by substitution	Ch. 9.4 – 9.6
13. Differential equations	Ch. 9.8, 9.9

Computer-based tools
No specified software tools are required in this course.

Learning process and workload
The course is taught over 45 hours divided in 39 hours of instruction and 6 hours of problem solving. Extensive problem solving is emphasized, and part of each the teaching session will be used on this. It is important that students attend the lectures well prepared by having a try at the tasks before the lectures.

Recommended time use:

Activity	**Time**
Participation in lectures	39
Attendance at problem solving lectures*	6
Preparation for lectures	120
Preparation for the exam	31
Exam	4
Total recommended time spent	**200**

* The problem solving lectures will be integrated with the ordinary lectures.

Use of hours

Examination
A four hour indivivual examination concludes the course.

Examination code(s)
ELE 37761 Written exam, counts 100% of the grade in ELE 3776 Mathematical Analysis, 7.5 credits.

Examination support materials
Interest tables and BI approved exam calculator.
Examination support materials at written examinations are explained under examination information in the student portal @bi. Please note use of calculator and dictionary in the section on support materials (https://at.bi.no/EN/Pages/Exa_Hjelpemidler-til-eksamen.aspx).

Re-sit examination
A re-examiniation is offered every term.

Additional information