



## COURSE SYLLABUS

# Mathematics for Doctoral Economics I, 7.5 credits

*Mathematics for Doctoral Economics I, 7,5 högskolepoäng*

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<b>Course Code:</b> FJMD139	<b>Education Cycle:</b> Third-cycle level
<b>Confirmed by:</b> Research Board Jun 12, 2019	<b>Research subject:</b> Economics
<b>Valid From:</b> Autumn 2019	
<b>Version:</b> 1	

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### Purpose

The Mathematics for Doctoral Economics I course is designed to help students be prepared for the mathematical material typically found in the economics (especially microeconomics) and statistics courses associated with doctoral programme in economics.

### Intended Learning Outcomes (ILO)

On completion of the course, the students will be able to:

#### Knowledge and understanding

- Indicate economic or statistics information that is transmitted by mathematical derivations covered in this course.
- Demonstrate an understanding of topological definitions and theorems, in particular fixed point theorems.

#### Skills and abilities

- Perform static unconstrained and constrained multivariable optimization and determine whether that optimization leads to maximization or minimization given the constraint(s).
- Apply the envelope theorem.
- Apply calculus rules that involve log or exponential functions.
- Determine vector spaces for sets of vectors.
- Solve sets of simultaneous equations using matrix algebra.
- Find eigenvalues for square matrices and demonstrate their use in optimization or in statistics.
- Derive statistical functions and measures from continuous probability density functions, e.g. joint distributions, marginal distributions, expectations and variances.

#### Judgement and approach

- Carry out mathematical derivations within the mathematical material covered with sufficient thoroughness to avoid largely unnecessary mistakes given time constraints.

### Contents

- (i) constrained optimization with inequality constraints
- (ii) the envelope theorem
- (iii) calculus rules involving logs and exponentials
- (iv) addition, multiplication, and inversion of matrices; vector spaces; solving sets of simultaneous equations using matrices; and eigenvalues and eigenvectors
- (v) unconstrained and constrained multivariable optimization
- (vi) Taylor series expansion
- (vii) the derivation of statistical functions and measures from continuous probability density functions
- (viii) concavity, convexity, quasi-concavity, and quasi-convexity characteristics of functions
- (ix) topological definitions and theorems, in particular fixed point theorems

### **Type of instruction**

Lectures and homework assignments.

The teaching is conducted in English.

### **Prerequisites**

Admitted to a doctoral programme in economics or a related subject of a recognized business school or university.

### **Examination and grades**

The course is graded Fail (U) or Pass (G).

The examination consists of three written examinations, with their contributions to the final overall grade

noted in parentheses below:

- Midterm examination (20%), which covers ILOs 1, 4, 5, 9, 10
- Final examination (80%), which covers ILOs 1, 2, 3, 6, 7, 8, 10

To pass the course the student needs to achieve at least 60% correct of the maximum possible points on

the final overall grade.

### **Course evaluation**

A course evaluation will be conducted at the end of the course.

### **Other information**

The course language is English.

### **Course literature**

The primary textbook is Chiang, Alpha C. and Wainwright, Kevin C. (2005) *Fundamental Methods of*

*Mathematical Economics* 4th edition, McGraw Hill [ISBN: 007-123823-9]

The course also uses material from Sydsaeter, K., Hammond, P., Seierstad, A. and A. Strom

(2008) Further

Mathematics for Economic Analysis, 2nd ed, Pearson [ISBN: 978-0-273-71328-9], including chapters 13 and 14, and Appendix A.

Supplementary material may also be assigned.