



# FSF3624 Random Matrices 7.5 credits

## Slumpmatriser

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

## Establishment

Course syllabus for FSF3624 valid from Spring 2011

## Grading scale

## Education cycle

Third cycle

## Specific prerequisites

A Master degree including at least 30 university credits (hp) in Mathematics.

A basic knowledge of integration theory (e.g. SF 2709 Integration theory), probability theory and functional analysis.

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

The goal of the course is to discuss the basic results in random matrix theory and also give some insight into the relation of random matrix theory to other areas, e.g. spectral theory and two-dimensional statistical physics.

## Course contents

- Basic ensembles in random matrix theory.
- Statistics of eigenvalues and eigenvectors.
- Coulomb gas and beta-ensembles.
- Invariant ensembles.
- Unitary ensembles and determinantal point processes.
- Orthogonal polynomial method.
- Local and global statistics. Loop equations.
- Dyson's Brownian motion.
- Non-invariant ensembles.
- Semi-circle law.
- Resolvent and combinatorial methods.
- General determinantal point processes and applications.

## Disposition

Lectures and seminars.

## Course literature

Handouts and lecture notes. A list of recommended literature will be handed out at the beginning of the course.

For the interested reader, we recommend the following books

- An Introduction to Random Matrices, by Greg Anderson, Alice Guionnet, Ofer Zeitouni
- Topics in Random Matrix Theory, by Terry Tao
- Orthogonal Polynomials and Random Matrices: A Riemann-Hilbert approach, by Percy Deift

## Examination

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Hand in assignments and an oral presentation on some topic related to the course.

## **Other requirements for final grade**

Accepted assignments and an oral presentation.

## **Ethical approach**

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.