

## MT3002 - The Mathematics and Statistics of Infectious Disease Outbreaks

### Course Overview

The course gives an introduction to the mathematical and statistical modelling of infectious diseases. This is an online course given in second half of the spring semester 2022, starting at the end of March 2022 (VTCD 2022).

### Contents

**Teachers:** [Tom Britton](#) and [Michael Höhle](#)

**Teaching Assistants:** Dongni Zhang, Andi Bodnariu, Jakob Torgander

### Course Plan

The course plan (in [Swedish](#) and [English](#)) contains a list of study goals and also describes the examination form. This includes:

- Epidemic Models: The SIR model
- Data situation in outbreaks
- Estimation of epidemic growth rate and the effective reproduction number
- Handling latencies and delays
- Vaccination
- Extending the SIR model: Networks, Age-Groups and other heterogeneities
- Outbreak detection
- COVID-19

### Schedule

Since this is a virtual course there is no direct schedule. The live sessions will take place twice a week, with recordings as well as live sessions. The exact schedule will be determined later.

### Further Information

Videos of the pre-recorded lectures will be made available through the moodle platform. In order to reach a larger audience, the videos are also available from the [SU video sharing platform](#) and [YouTube](#).

## Examination

### Examinator

Tom Britton and Michael Höhle

### Examination form

Home Exam and Project work – see course plan (in [Swedish](#) and [English](#)). This consists of

- Written home exam for the theory part (3.5 ECTS): Point scale with thresholds determining the grades from A-F. All literature is allowed.
- Individual project work (4.0 ECTS): Two projects:
  - Project 1: The individual exercises of the project are given points.
  - Project 2: Open project. Combination of points in the following 5 categories: Compliance with course goals, Technical difficulty and novelty, Clarity of the programming, Readability and clarity of the report, Reproducibility of the report.

## Literature

Throughout the course we will use individual resources, because there is no good book covering both the mathematical modelling and the statistical inference part on a basic level. Good sources to get an overall overview of mathematical modelling in infectious diseases, but not course literature per-se (i.e. it's voluntary to read). We shall also link to particular papers for individual lectures.

- Becker, N, Modeling to Inform Infectious Disease Control (2015), <https://www-taylorfrancis-com.ezp.sub.su.se/books/9780429155451>
- Diekmann O, Heesterbeek H, Britton T, Mathematical Tools for Understanding Infectious Disease Dynamics (2013), <https://www-degruyter-com.ezp.sub.su.se/view/title/512253>
- Keeling MJ, Rohani P, Modeling Infectious Diseases (2008), <https://www-degruyter-com.ezp.sub.su.se/view/title/563052>

Some papers that could be of interest:

- Britton, T. (2010). Smittsamma sjukdomars matematik. Normat 58: 63-75. (In Swedish). Found as pdf below.
- Britton, T. (2010). Stochastic epidemic models: a survey. [Math. Biosci](#), 225, 24-35 (see below). The paper contains an error, see Errata below. This is too technical for the course, so only for those interested.

## Programming

In the course we will illustrate models and their inference through programming code. In the lectures will use the [statistical programming environment R](#) for this. R is best used together with an IDE such as, e.g., [RStudio](#). However, even though we strongly recommend to use R, you are free in your choice of programming environment to use for your project work. A good resource to learn programming with R is [The Art of R Programming](#) book by Matloff (relevant for our course). An excellent resource for a data based view on analysis is [R for Data Science](#) book by Wickham and Grolemund (used in the [Statistical Data Processing Class](#), but less relevant for our course) or some of the [RStudio Tutorials on R](#) programming.

## Application procedure

You have to apply for the course by October 15 2021. In order to apply, please go to one of the following two links ([Swedish](#) or [English](#)). For more general information about how to apply for bachelor courses in Sweden, go to [this link](#).