## Epidemic Models (61228)

### *Instructors: N.DEMIRIS*

Core Course, 2nd semester, 4 ECTS units
Course level: Graduate (MSc)
Language: Greek/English

**Course Description**

- Introduction to Stochastic Epidemic Modelling, Stochastic versus deterministic models. Stochastic epidemics in large communities. The Markovian case, Some Exact results. Chain-binomial models.
- Coupling methods. Applications to the early stage of epidemics and the connection with branching processes. The threshold limit theorem, Duration of the Markovian SIR epidemic. Density dependent jump Markov processes.
- Disease Control, Estimation of vaccine efficacy. Estimating vaccination policy.
- Multitype epidemics and multiple age-groups. Household models and population structure. Epidemics and graphs, Random graph interpretation, Epidemics and social networks. Implications for vaccination.
- Bayesian Inference for epidemic models. Inference for ODE models. Approximate inference for stochastic models.
- Applications using data from influenza outbreaks and the SARS-CoV2 pandemic.

**Prerequisites**

Probability and Statistical Inference. Computational methods.

**Target Learning Outcomes**

At the end of the course the student will have a basic understanding of disease transmission and the relevant factors which affect it. Disease control techniques and parameter estimation will be possible, including the estimation of the relevant function(al)s such as the disease reproductive rate and the vaccination coverage.

**Recommended Bibliography**

Andersson H. and Britton T. (2000): *Stochastic epidemic models and their statistical analysis*. Springer Lecture Notes in Statistics, 151. Springer-Verlag, New York.

**Teaching and Learning Activities**

Classroom teaching (or via teleconference). Practicals on the computational inference techniques.

**Assessment and Grading Methods**

Exercises during the course. A large study based on analyzing real epidemic data and oral presentation at the end of the course.