MSB7207: Disease Dynamics and Modelling (3 CU)

Course Description

Modelling of the dynamics of infectious diseases is becoming increasingly important for improving understanding about transmission and the potential impact of public health interventions. In this course, students will be introduced to the basic concepts of mathematical modelling of infectious diseases such as the basic reproductive number. We will further discuss issues such as vaccination thresholds, stochastic effects during epidemic growth and social networks. The students will be able to work on real-life applications of infectious disease modelling with case studies of influenza and chlamydia, a bacterial sexually transmitted infection. Exercises will be conducted in the programming language R. Previous knowledge of R will be useful but is not essential.

Course Objectives

At the end of this course, the student should be able to:

1. Describe basic concepts in mathematical epidemiology
2. Explain principles of constructing simple mathematical models for a number of infectious diseases
3. Describe approaches used to compare model simulations with data as a means of validating different models
4. Discuss new models for infectious diseases

Course Learning Outcomes

By the end of the course, students should be able to:

1. Show an understanding of the theory behind mathematical modelling of infectious diseases

2. Use appropriate techniques to analyse the dynamics of infectious disease outbreaks
3. Integrate different sources of data into mathematical modelling framework
4. Construct a suitable model for specified infectious diseases

Indicative Content

No.	Content	Contact Hours
1	Introduction to mathematical epidemiology	4
2	Basic concepts of population dynamics	4
3	Compartmental models	4

4	Basic reproduction number	4
5	Parameter inference and seasonal forcing	4
6	Stochastic effects (observational and process noise)	4
7	Gillespie algorithm	4
8	Global control of sexually transmitted infections	4
9	Determinants of STI transmission (sexual networks)	4
10	Modelling the transmission of STIs	4

11	Fitting models to data and network models	5
	Total	**45**

Mode of Delivery:
This course will encourage participatory and active learning. Learning will be facilitated through lectures, tutorials, laboratory sessions, seminars, Individual and group work comprising of assignments.

Mode of Assessment

1. Individual assignment 10%
2. Group assignments 20%
3. Course assessment Tests 10%
4. Final examination 60%

Reading List

1. R.M. Anderson and R.M. May, Infectious Diseases of Humans: Dynamics and Control, Oxford University Press.

2. O. Diekmann, H. Heesterbeek and T. Britton, Mathematical Tools for Understanding Infectious Disease Dynamics, 2013, Princeton University Press.