COURSE DESCRIPTION

- Course name: Modelling with stochastic differential equations

Form of course	***Lecture***	***Tutorial***	***Laboratory***	***Project***	***Seminar***
Total number of hours	***20***		***26***		***14***
Form of completion	***quiz***		***simulation exercises***		***presentations***

- Initial requirements: basic probability theory, methematical analysis and programming
- Name, surname, title of teacher: Jakub Ślęzak
- Aims of course and educational outcomes: gaining knowledge about basic stochastic models in physics, biology and finance; obtaining skills to perform related simulations and fitting data to the model
- Form of teaching (traditional / e-learning): traditional
- Short description of the course content: we will describe the most important random models useful in applications, such as Brownian motion, arithmetical and geometrical Brownian motion and Ornstein-Uhlenbeck; we will also show the main methods of simulation and statistical analysis
- Lecture – content:

Form of classes - lecture		**Number of hours**
Lec1	Random variables and statistics	2
Lec2	Description of random phenomena in time	2
Lec3	Brownian motion in physics and finance	2
Lec4	Stochastic integral	3
Lec5	Langevin equation and Vasicek model	2
Lec6	Stochastic RLC circuit	2
Lec7	Stochastic population models	2
Lec8	General methods of solution	2
Lec9	Some advanced models	2
Lec10	Quiz and summary	1
	Total hours	**20**

- Laboratory – content:

Form of classes - laboratory		**Number of hours**
Lab1	Generating samples of random variables	3
Lab2	Basic estimation methods	3
Lab3	Simulating and analyzing noise	3
Lab4	Brownian motion and random walk	3
Lab5	Stochastic Euler method in one dimension	3
Lab6	Stochastic Euler method in many dimensions	3
Lab7	Simulating and analysis of population models	3
Lab8	Nonlinear models	3
Lab9	Advanced models	2
	Total hours	**26**

- Seminar– content:

Form of classes – seminar		Number of hours
Sem1	Presentation on the results obtained at laboratory	14

- Basic literature: K. Sobczyk „Stochastic differential equations”, C.W. Gardinder „Handbook of stochastic methods”
- Additional literature: B. Øksendal „Stochastic differential equations”
- Completion rules: programming exercises and knowledge quiz