DISCRETE MODELING

Course Workload		Assessment form (examination/ graded test/ ungraded test)
ECTS	Hours	
3	108	Written exam

Students will gain knowledge about modern methods of solving applied problems, queuing systems, and event models. You will learn the classification of methods and modern modelling technologies, queuing systems, analytical models, Markov models, parallel and distributed modelling technologies. You will be able to model complex systems and distinguish between modelling techniques. You will get acquainted with the methods of developing discrete-event models using cellular automata, methods of statistical processing of simulation results, methods of verification and validation of models, methods of analyzing simulation results. You will learn how to use modern software environments for mathematical modelling and simulation. You will be able to plan experiments with the developed models; learn how to design discrete and continuous models in Mathcad.

Course structure:

1. MODELLING PRINCIPLES
    1.1. Definition of the mathematical model. A systematic approach to describing models. Classes of models. Application of models to the solution of various classes of problems. Simulation goals.
    1.2. Simulation modeling. Features of the model approach to problem solving. Areas of application of mathematical modeling. Basic steps in building models.
    1.3. The role of visualization in building models and analyzing simulation results. The benefits of modeling as a way to solve problems. Disadvantages of modeling.

2. MODELING DISCRETE TIME SYSTEMS BASED ON EVENTS
    2.1. The difference between systems with discrete and continuous time. Basic concepts of queuing systems. Parameters of models with queues: arrival rate, service rate, number of servicing devices. Simulation tables. Specification of systems based on discrete events.

3. STATISTICAL INPUT MODELS
    3.1. Generation of random variables with a given distribution law. Moments of distribution of random variables. Statistical models in queued systems. Application of statistical models in reliability problems. Poisson process.

4. ANALYSIS OF SIMULATION RESULTS
    4.1. Stability of behavior of systems with random input. Statistical equilibrium. Estimation of statistical properties of simulation results for known input distributions. Comparison of accurate estimates with simulation results.