Courses in English
Course Description

Department	07 Computer Science and Mathematics
Course title	**Modeling and Simulation**
Hours per week (SWS)	4
Number of ECTS credits	5
Course objective	Instrumental and systemic competencies - Students should acquire knowledge and skills to describe primarily technical-physical relationships in models in their professional environment and to simulate them with the aid of a computer. - The necessary specialist knowledge is imparted and students are instructed to collect and evaluate information themselves. - They learn to derive scientific and practical findings from the models. They are enabled to evaluate their own work results and the results of third parties. Supra-disciplinary, especially communicative competencies - Work in groups is intended to promote the ability to communicate - Collaborative development of models in student research projects is intended to increase the ability to work in a team - Mutual reviews of student research projects are intended to train judgment.
Prerequisites	- Basic mathematical subjects from the Bachelor of Computer Science - Programming skills e.g. Jupyter notebooks for scripts and Java for object-oriented programming - Statistics, numerics, basic knowledge of machine learning are advantageous
Recommended reading	
Teaching methods	Blackboard, slides or projections virtual partial events via BigBlueButton - computers, B17software tools such as Jupyter notebooks, Sagemath, R, programming languages such as Python, Java - Moodle as electronic learning platform repositories with version management (Git, SVN), ticket systems, boards (e.g. Kanban, Scrum) - virtual conference systems with evaluation systems (e.g. EasyChair) for mutual reviews
Assessment methods	- Blackboard, slides or projections - virtual partial events via BigBlueButton - computers, software tools such as Jupyter notebooks, Sagemath, R, programming languages such as Python, Java - Moodle as electronic learning platform repositories with version management (Git, SVN), ticket systems, boards (e.g. Kanban, Scrum) - virtual conference systems with evaluation systems (e.g. EasyChair) for mutual reviews
Language of instruction	English
Name of lecturer	Prof. Dr. Gerta Köster
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Link	

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Course content

Contents:
- methodological basics of modeling and simulation of systems from various   application areas: from observation to abstraction to model, from model to   discretization to algorithm, from algorithm to simulation - and validation   against observation
- most important components, operation and handling of a simulation system
- development, implementation and simulation of concrete models for selected   problems from application areas like (e. g. telecommunication, agent models,   traffic, mechanics, e-technology, chemistry, biology, economy,…)
- verification and validation, evaluation of results
- data driven models from machine learning versus "classical" modeling

Possible focus:
- Observation by experiment, data collection, data analysis
- Discrete event simulations (queues)
- Cellular automata and cellular networks (e.g., traffic models)
- Continuous models
- Differential equations
- data-driven machine learning models in the context of classical modeling, mixed   approaches, digital twins

Remarks