Elective Module QM: Operations Research **Responsible: Helmes / Brandt**			**Study Points: 6-18**
Goals: The „Elective Module Operations Research“ (for master students) is composed of fundamental and advanced courses as well as special topic courses and seminars. It offers the opportunity to become a specialist in Operations Research applications. The basic courses (OR I and OR II) cover classical material on linear and nonlinear programming. The advanced courses (OR III and OR IV) are devoted to dynamic programming and applied project work. They aim to provide students with the opportunity to gain enhanced theoretical knowledge and theory oriented as well as applied project experience. As part of the module special topic courses on a variety of business management specializations are offered, e. g. Revenue Management, Operational Risk Management, Operations Management, Financial Engineering, Queueing theory, inventory theory, logistic and supply chain management, simulation studies, stochastic modelling and optimization algorithms, etc. Within special seminars students will learn to use and to apply OR-software packages.			
Prerequisites to participate in the module: none			
Course	Periods/ Week	SP; work load	Topics
Basic Lectures			
Lecture/ Tutorial OR I	3	4,5; Attendance (45 h) Preparation (60 h) Exam preparation (30 h)	Simplex algorithms, theory on duality and sensitivity analysis, production-, cutting-stock and blending problems, staffing and scheduling problems, quadratic optimization
Lecture/ Tutorial OR II	3	4,5; Attendance (45 h) Preparation, presentation (30 h) Project work (60 h)	Integer programming with the view towards applications, knapsack problem, transportation and assignment problems, network flow optimization and project planning
Advanced Lectures			
Lecture/ Tutorial OR III	3	4,5; Attendance (45 h) Preparation (60 h) Exam preparation (30 h)	Deterministic and stochastic dynamic programming; solution algorithms, business and economic applications
Lecture/ Seminar OR IV	3	4,5; Attendance (45 h) Preparation, presentation (30 h) Project work (60 h)	Lectures based on research articles, presentation of thesis and project work
Special lectures			
Every lecture marked as Special OR lecture in the university calendar	3	4,5; Attendance (45 h) Preparation (60 h) Exam preparation (30 h)	There will be special lectures on OR topics every semester.
Seminars			
Software in Operations Research	2	6; Attendance (30 h) Preparation (30 h) Seminar paper and presentation (90 h + 30 h)	Introduction into the usage of, e. g. AMPL, OPL, AIMMS, NEOS, etc.; syntactic elements of model languages; linear, piecewise linear, quadratic and integer valued optimization problems

Software project	2	3; Implementation, documentation und presentation (90 h)	Developing software packages; long term projects
Research Seminar	2	3; Attendance (30 h) Reports and presentation (60 h)	Lectures on research projects
Module examinations		Lecture/Tutorial OR I: Written exam (120 min) Lecture/Tutorial OR II: Written exam (120 min) Lecture/Tutorial OR III: Written exam (120 min) Lecture/Tutorial OR IV: Written exam (120 min) Seminar Software in OR: work reports (50 %), presentation (40 %), exercises (10 %) Lecture/Tutorial Excel in OR: Written exam (60 min) or oral exam (20 min) Lecture/Tutorial OR Special: Written exam (120 min) or oral exam (20 min)	
Duration of the module		☒ 1 Semester ☐ 2 Semesters	
Module can be started in		☒ Fall Semester ☒ Spring Semester or	