Number of module	**Name of module**	**Lecturer**
BIWO-03	Energy Methods, FEM	Prof. Kaliske
Content and qualification aim	Content of the module: • Introduction to calculus of variations • Minimal principle of potential energy • Approximative solution according to Ritz and Galerkin • Energetic stability criteria and their application • Hamilton's law, Hamilton's principle • Lagrange-equations, application to stationary and non-stationary vibrations • Minimal principle of complementary energy • Displacement forms of FEM • Generalized variational principles and hybrid finite elements • Geometrically nonlinear FEM • Physically nonlinear FEM • Numerical simulation of fracture After having finished the module successfully students have in-depth knowledge about energy methods, which form the basis for the finite element method, as well as about the linear and non-linear finite element method itself.	
Type of course	4 hours of lectures, 2 hours of exercises per week, and self-study	
Requirements for study		
Practical use of the module	Obligatory module in the Master's programme: Advanced Computational and Civil Engineering Structural Studies. The module provides the prerequisites for the elective modules BIWE-02, BIWE-03, BIWE-09 and BIWE-13.	
Requirements for the award of credits	The credits are awarded if the module examination is successfully passed. The module examination consists of a written examination (120 min). Prerequisite for the examination is an assignment of 40 hours.	
Credits and grades	8 credits can be acquired for this module. The grade is the grade of the written examination.	
Frequency of module	The module is offered every academic year (winter semester).	
Workload	The workload is 240 working hours.	
Duration of the module	1 semester.	
Recommended literature	Chandrupatla, Belegundu: Introduction to Finite Elements in Engineering, Prentice-Hall Zienkiewicz, Taylor: The Finite Element Method, Butterworth-Heinemann	