

Curriculum Subsurface Engineering

| Kind of Module | Specialization | Code | Module Name | Coordinators and Lecturers | CP | WLH | Sem. | WiSe / SoSe | Examination Methods |
|--------------------------|----------------|--------|--|---|-------------|-------------|------|-------------|--------------------------------|
| Compulsory: 33 CP | | SE-C-1 | Mathematical Aspects of Differential Equations and Numerical Mathematics | Prof. Dr. Gerhard Röhrle | 6 | 4 | 1 | WiSe | exam (180 min) |
| | | SE-C-2 | Finite Element Methods in Linear Structural Mechanics | Prof. Sauer | 6 | 4 | 1 | WiSe | exam (180 min) |
| | | SE-C-3 | Geology of the Earth's Crust a) Special methods in structural geology (block course) b) Structural geology field camp | Prof. C. Pascal Prof. W. Friederich, Prof. J. Renner | 6 3 3 | 4 | 1 | WiSe | exam (120 min) essay (20 h) |
| | | SE-C-4 | Groundwater Hydraulics | Dr. T. Heinze | 5 | 4 | 1 | WiSe | exam (60 min) |
| | | SE-C-5 | Soil and rock behaviour a) Soil Behaviour and Simple Constitutive Models for Soils b) Stress field and rock mass behavior (block course) | Prof. T. Wichtmann (coordinator) Prof. T. Backers | 6 3 3 | 6 2 4 | 1 | WiSe | exam (180 min) |
| | | SE-C-6 | Project Work | Professors, lecturers and assistants | 4 | - | 3 | WiSe | Home Assignment + presentation |

| Compulsory Optional: GT + SCU: 42 | Geotechnics and Tunneling GT: 30 CP (If You choose this Specialization) | | Both Specializations | | Subsurface Characterization and Utilization SCU: 30 CP (If You choose this Specialization) | | | |
|--|---|---|---|------------------|--|----------------------|---------------------------|---|
| | SE-CO-1 | Foundation Engineering and Utility Pipe Construction: Design-Engin.-Techn. a) Design, engineering and technologies in Foundation Engineering b) Design, engineering and technologies in Utility Pipe Construction | Prof. M. Thewes (coordinator) Dr. B. Schoesser | 6 3 3 | 4 | 3 | WiSe | exam (120 min) Home Assignment (30 h) |
| | SE-CO-2 | Conventional and Mechanised Tunneling: Design-Engineering-Technologies a) Design, engineering and technologies in Tunneling b) Design, engineering and technologies in Pipeline Construction | Prof. M. Thewes (coordinator) Dr. B. Schoesser | 6 3 3 | 4 | 2 | SuSe | exam (120 min) Home Assignment (30 h) |
| | SE-CO-3 | Numerical Simulation in Geotechnics and Tunneling a) Numerical Simulation in Tunneling b) Numerical Simulation in Geotechnics | Prof. G. Meschke (coordinator) Dr. C. Schmüdderich | 6 3 3 | 4 | 2 | SuSe | exam (180 min) |
| | SE-CO-5 | Operation and Maintenance of Tunnels and Utility Pipes a) Facility management of underground transportation infrastructure b) Pipeline maintenance and network management | Prof. M. Thewes (coordinator) Prof. R. Leuker Prof. B. Bosseler | 6 3 3 | 4 | 3 | WiSe | exam (120 min) 60 min |
| | SE-CO-6 | Design of Geotechnical Structures 1 Shallow and Deep Foundations | Prof. T. Wichtmann (coordinator) Dr. M. Tafili, Dr. N. Irani, Dr. M. Salimi | 6 | 4 | 2 | SuSe | exam (180 min) |
| | SE-CO-14 | Design of Geotechnical Structures 2 Excavation Pits, Retaining Structures and Soil Improvement | Prof. T. Wichtmann (coordinator) Dr. M. Tafili, Dr. N. Irani, Dr. M. Salimi | 6 | 4 | 3 | WiSe | exam (180 min) |
| | SE-CO-7 | Problematic Soils and Soil Dynamics a) Problematic soils b) Soil Dynamics c) Geotechnical Earthquake Engineering | Prof. T. Wichtmann (coordinator) Dr. W. Baille Dr. M. Goudarzy Dr. F. Prada (Lehrbeauftragter) | 6 3 2 1 | 4 2 1 1 | 3 | WiSe | exam (180 min) |
| | SE-CO-8 | Numerical Methods and Stochastics | Jun.-Prof. Dr. Markus Weimar, Prof. J. Lederer | 6 | 4 | 2 | SuSe | exam (180 min) |
| | SE-CO-10 | Constitutive models for geomaterials a) FEM for Nonlinear Analyses of Inelastic Materials and Structures b) Advanced Constitutive Models for Soils | Prof. T. Wichtmann (coordinator) Prof. R. Sauer Dr. M. Tafili, Dr. C. Schmüdderich | 6 3 3 | 4 | 2 | SuSe | exam (120 min) optional Home-work |
| | SE-CO-11 | Ground Exploration Methods a) Geophysical Inverse Problems b) Seismic and electromagnetic field methods | Prof. W. Friederich (coordinator) | 10 5 5 | 6 | 3 | WiSe | exam (120 min) |
| | SE-CO-19 | Mechanical Modeling of Materials | Prof. D. Balzani (coordinator) | 6 | 4 | 3 | WiSe | exam (90 min) |
| | SE-CO-12 | Applied Geophysics a) Reservoir Geophysics b) Rock Physics | Prof. J. Renner (coordinator) | 10 5 5 | 6 | 2 | SuSe | exam (180 min) report on Lab experiments |
| | SE-CO-13 | Geothermal Energy Systems | Prof. R. Bracke (coordinator) | 5 | 4 | 2 | SuSe | exam (60 min) Optional Homework (40 h) |
| | SE-CO-15 | Hydrogeological Methods a) Tracers in Hydrogeology b) Hydrogeological Field Camp | Dr. T. Heinze | 8 | 6 | 2 | SuSe | report (10 h) + active Participation |
| | SE-CO-16 | Seismotectonics and Seismic Hazard | Prof. R. Harrington (coordinator), Dr. A. Verdecchia | 6 | 4 | 3 | WiSe | exam (120 min) + reports |
| | SE-CO-17 | Selected Topics in Reservoir Characterization a) Deep geothermal energy b) Well logging rudiments c) Well logging II, analysis, interpretation | Prof. J. Renner (coordinator) | 9 5 2 2 | 7 3 2 2 | 2,4 3 3 2,4 | both SuSe WiSe SuSe | exam (180 min) + handed in Assignments |
| | SE-CO-18 | Reservoir Engineering | Prof. E. H. Saenger (coordinator) | 5 | 3 | 3 | WiSe | Oral Talk (60 min) |

| Optional: 15 CP | SE-O-1 | Practical Training on Tunneling and Pipeline Construction Techniques | Prof. M. Thewes (coordinator) | 2 | 3 | 2 | SuSe | full time participation |
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| | SE-O-2 | Aspects of Design and Construction of Tunnels and other Subsurface Infrastructure in Practice | Prof. M. Thewes (coordinator) | 2 | 2 | 3 | WiSe | full time participation |
| | SE-O-3 | Technologies in Mechanised Tunneling | Prof. M. Thewes (coordinator), Dr. G. Wehrmeyer | 2 | 2 | 2 | SuSe | exam (60 min) |
| | SE-O-4 | Practical Soil Mechanics | Prof. T. Wichtmann (coordinator), Dr. W. Baille | 3 | 2 | 3 | WiSe | exam (90 min) + Exercise Protocols + Attendance |
| | SE-O-5 | Environmental Geotechnics | Prof. T. Wichtmann (coordinator), Dr. W. Baille, Dr. D. König | 3 | 2 | 2 | SuSe | exam (90 min) + Presentation |
| | SE-O-6 | Variational Calculus and Tensor Analysis | Prof. Dr.-Ing. Johanna Waimann, Prof. Dr.-Ing. Daniel Balzani, Prof. Dr. rer. nat. Khanh Chau Le | 5 | 3 | 3 | WiSe | exam (90 min) |
| | SE-O-7 | Digital Rock Physics | Prof. E. Saenger (coordinator) | 5 | 3 | 2 | SuSe | Home Assignment (30 h) |
| | SE-O-8 | High Performance Computing on Multicore Processors | Prof. A. Vogel (coordinator) | 6 | 4 | 2 | SuSe | exam (120 min) |
| | SE-O-9 | High Performance Computing on Clusters | Prof. A. Vogel (coordinator) | 6 | 4 | 3 | WiSe | exam (120 min) |
| | SE-O-10 | Scientific Programming | Prof. A. Vogel (coordinator) | 6 | 4 | 3 | WiSe | exam + report about Exercises |
| | SE-O-14 | Training of Competences (Part 1) | University Language Center (ZFA) of Ruhr-University Bochum | 4 | 4 | 1 | WiSe | exam (120 min) + Homework (20 h) |
| | SE-O-15 | Training of Competences (Part 2) | University Language Center (ZFA) of Ruhr-University Bochum | 4 | 4 | 2 | SoSe | exam (120 min) |
| | SE-O-16 | Introduction to advanced numerical methods for particulate media | Prof. T. Wichtmann (coordinator), Dr.-Ing. M. Salimi | 3 | 2 | 3 | WiSe | Homework (60h) |

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| Master Thesis: 30 CP | SE-MT | Master Thesis | Professors, lecturers and assistants | 30 | - | 4 | SuSe | Master Thesis and Oral Presentation |
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| All Modules: 120 CP | SE-C | Subtotal Compulsory Courses | | 33 | | 1 | WiSe | |
| | SE-CO | Subtotal Compulsory Optional Courses (Minimum 30 CP in chosen Specialization) | | 42 | | 2,3 | both | |
| | SE-O | Subtotal Optional Courses | | 15 | | 2,3 | both | |
| | SE-MT | Subtotal Master Thesis | | 30 | | 4 | SuSe | |
| | | Sum | | | 120 | | | |