

## Curriculum Subsurface Engineering

| Category                                          | Specializ.                                                                                                                                                                                         | Module No.                           | Module name                                                                                                                                            | Coordinator / Lecturers                                                           | CP                                                                                                                                                                                                                      | Sem.                                            |                              |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------|
| Compulsary: 33 CP                                 | Both Specializations (GT + SCU)                                                                                                                                                                    | SE-C-1                               | Mathematical Aspects of Differential Equations and Numerical Mathematics                                                                               | Prof. B. Bramham (coordinator)                                                    | 6                                                                                                                                                                                                                       | 1                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-C-2                               | Finite Element Methods in Linear Structural Mechanics                                                                                                  | Prof. R. Sauer (coordinator)                                                      | 6                                                                                                                                                                                                                       | 1                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-C-3                               | Geology of the Earth's Crust<br>a) Special Methods in Structural Geology (block course)<br>b) Structural Geology Field Camp (block course)             | Prof. C. Pascal<br>Prof. W. Friederich                                            | 6<br>3<br>3                                                                                                                                                                                                             | 1                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-C-4                               | Groundwater Hydraulics                                                                                                                                 | Dr. T. Heinze (coordinator)                                                       | 5                                                                                                                                                                                                                       | 1                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-C-5                               | Soil and Rock Behaviour<br>a) Soil Behaviour and Simple Constitutive Models for Soils<br>b) Stress Field and Rock Mass Behavior (block course)         | Prof. T. Wichtmann (coordinator)<br>Prof. T. Backers                              | 6<br>3<br>3                                                                                                                                                                                                             | 1                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-C-6                               | Project Work                                                                                                                                           | Professors, lecturers and assistants                                              | 4                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | Compulsary Optional: GT + SCU: 42 CP | Geotechnics and Tunneling (GT)                                                                                                                         | SE-CO-1                                                                           | Foundation Engineering and Utility Pipe Construction: Design-Engin.-Techn.<br>a) Design, engineering and technologies in Foundation Engineering<br>b) Design, engineering and technologies in Utility Pipe Construction | Prof. M. Thewes (coordinator)<br>Dr. B. Schößer | 6<br>3<br>3                  |
| SE-CO-2                                           | Conventional and Mechanised Tunneling: Design-Engineering-Technologies<br>a) Design, engineering and technologies in Tunneling<br>b) Design, engineering and technologies in Pipeline Construction |                                      |                                                                                                                                                        | Prof. M. Thewes (coordinator)<br>Dr. B. Schößer                                   | 6<br>3<br>3                                                                                                                                                                                                             | 2                                               | SuSe                         |
| SE-CO-3                                           | Numerical Simulation in Geotechnics and Tunneling                                                                                                                                                  |                                      |                                                                                                                                                        | Prof. T. Wichtmann (coordinator)<br>Dr. C. Schmüdderich                           | 6                                                                                                                                                                                                                       | 2                                               | SuSe                         |
| SE-CO-5                                           | Operation and Maintenance of Tunnels and Utility Pipes<br>a) Facility management of underground transportation infrastructure<br>b) Pipeline maintenance and network management                    |                                      |                                                                                                                                                        | Prof. M. Thewes (coordinator)<br>Prof. R. Leuker<br>Prof. B. Bosseler             | 6<br>3<br>3                                                                                                                                                                                                             | 3                                               | WiSe                         |
| SE-CO-6                                           | Design of Geotechnical Structures - Shallow and Deep Foundations                                                                                                                                   |                                      |                                                                                                                                                        | Prof. T. Wichtmann (coordinator)<br>Dr. N. Irani                                  | 6                                                                                                                                                                                                                       | 2                                               | SuSe                         |
| SE-CO-7                                           | Soil Dynamics and Geotechnical Earthquake Engineering<br>a) Soil Dynamics<br>b) Geotechnical Earthquake Engineering                                                                                |                                      |                                                                                                                                                        | Prof. T. Wichtmann (coordinator)<br>Dr. M. Goudarzy<br>Dr. F. Prada, Dr. N. Irani | 6<br>3<br>3                                                                                                                                                                                                             | 3                                               | WiSe                         |
| SE-CO-14                                          | Design of Geotechnical Structures -<br>Excavation Pits, Retaining Structures and Soil Improvement                                                                                                  |                                      |                                                                                                                                                        | Prof. T. Wichtmann (coordinator)<br>Dr. M. Tafili, Dr. N. Irani                   | 6                                                                                                                                                                                                                       | 3                                               | WiSe                         |
| SE-CO-21                                          | Optimization Aided Design - Reinforced Concrete                                                                                                                                                    |                                      |                                                                                                                                                        | Prof. P. Mark (coordinator)                                                       | 6                                                                                                                                                                                                                       | 2                                               | SuSe                         |
| Both Specializations (GT + SCU)                   | SE-CO-8                                                                                                                                                                                            |                                      | Numerical Methods and Stochastics                                                                                                                      | Prof. M. Kronbichler (coordinator)                                                | 6                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   | SE-CO-10                                                                                                                                                                                           |                                      | Advanced Constitutive Models for Geomaterials                                                                                                          | Prof. T. Wichtmann (coordinator)<br>Dr. C. Schmüdderich, Dr. M. Tafili            | 6                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   | SE-CO-11                                                                                                                                                                                           |                                      | Ground Exploration Methods<br>a) Geophysical Inverse Problems<br>b) Seismic and electromagnetic field methods                                          | Prof. W. Friederich (coordinator)                                                 | 10<br>5<br>5                                                                                                                                                                                                            | 3                                               | Wise                         |
|                                                   | SE-CO-19                                                                                                                                                                                           |                                      | Mechanical Modeling of Materials                                                                                                                       | Prof. D. Balzani (coordinator)                                                    | 6                                                                                                                                                                                                                       | 3                                               | Wise                         |
|                                                   | SE-CO-20                                                                                                                                                                                           |                                      | Inelastic Finite Element Method for Structures                                                                                                         | Prof. R. Sauer (coordinator)<br>Dr. V. Gudzulic                                   | 6                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   | SE-CO-22                                                                                                                                                                                           |                                      | Geothermal Drilling Engineering and Subsurface Technologies                                                                                            | Prof. R. Bracke (coordinator)                                                     | 5                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   | SE-CO-23                                                                                                                                                                                           |                                      | Nonlinear Finite Element Method for Structures                                                                                                         | Prof. R. Sauer (coordinator)                                                      | 6                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   | SE-CO-24                                                                                                                                                                                           |                                      | Rock Mass Mechanics and Rock Engineering                                                                                                               | Prof. T. Backers (coordinator)<br>Dr. M. Duda                                     | 6                                                                                                                                                                                                                       | 2                                               | SuSe                         |
| Subsurface Characterization and Utilization (SCU) | SE-CO-12                                                                                                                                                                                           |                                      | Applied Geophysics<br>a) Reservoir Geophysics<br>b) Rock Physics                                                                                       | Prof. J. Renner (coordinator)                                                     | 10<br>5<br>5                                                                                                                                                                                                            | 2                                               | SuSe                         |
|                                                   | SE-CO-13                                                                                                                                                                                           |                                      | Geothermal Energy Systems                                                                                                                              | Prof. R. Bracke (coordinator)                                                     | 5                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   | SE-CO-15                                                                                                                                                                                           |                                      | Hydrogeological Methods<br>a) Tracers in Hydrogeology<br>b) Hydrogeological Field Camp                                                                 | Dr. T. Heinze (coordinator)                                                       | 8                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   | SE-CO-16                                                                                                                                                                                           |                                      | Seismotectonics and Seismic Hazard                                                                                                                     | Prof. R. Harrington (coordinator)<br>Dr. D. Essing                                | 6                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   | SE-CO-17                                                                                                                                                                                           |                                      | Selected Topics in Reservoir Characterization<br>a) Deep geothermal energy<br>b) Well logging rudimens<br>c) Well logging II, analysis, interpretation | Prof. J. Renner (coordinator)                                                     | 9<br>5<br>2<br>2                                                                                                                                                                                                        | 2,4<br>3<br>2,4                                 | both<br>SuSe<br>WiSe<br>SuSe |
|                                                   | SE-CO-18                                                                                                                                                                                           |                                      | Reservoir Engineering                                                                                                                                  | Prof. E.H. Saenger (coordinator)                                                  | 5                                                                                                                                                                                                                       | 3                                               | WiSe                         |
| Optional: 15 CP                                   | Both Specializations (GT + SCU)                                                                                                                                                                    |                                      | SE-O-1                                                                                                                                                 | Practical Training on Tunneling and Pipeline Construction Techniques              | Prof. M. Thewes (coordinator)                                                                                                                                                                                           | 2                                               | 2                            |
|                                                   |                                                                                                                                                                                                    | SE-O-2                               | Aspects of Design and Construction of Tunnels and other Subsurface Infrastructure in Practice                                                          | Prof. M. Thewes (coordinator)                                                     | 2                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-3                               | Technologies in Mechanised Tunneling                                                                                                                   | Prof. M. Thewes (coordinator)<br>Dr. G. Wehrmeyer                                 | 2                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-4                               | Practical Soil Mechanics                                                                                                                               | Prof. T. Wichtmann (coordinator)<br>Dr. W. Baille                                 | 3                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-5                               | Environmental Geotechnics                                                                                                                              | Prof. T. Wichtmann (coordinator)<br>Dr. W. Baille, Dr. D. König                   | 3                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-6                               | Variational Calculus and Tensor Analysis                                                                                                               | Prof. J. Waimann (coordinator)<br>Dr. U. Hoppe                                    | 5                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-7                               | Digital Rock Physics                                                                                                                                   | Prof. E.H. Saenger (coordinator)                                                  | 5                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-8                               | High-Performance Computing on Multicore Processors                                                                                                     | Prof. A. Vogel (coordinator)                                                      | 6                                                                                                                                                                                                                       | 2                                               | SuSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-9                               | High-Performance Computing on Clusters                                                                                                                 | Prof. A. Vogel (coordinator)                                                      | 6                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-10                              | Scientific Programming                                                                                                                                 | Prof. A. Vogel (coordinator)                                                      | 6                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-16                              | Introduction to advanced numerical methods for particulate media                                                                                       | Prof. T. Wichtmann (coordinator)<br>Dr. M. Salimi                                 | 3                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-17                              | Uncertainty Quantification in FE Analyses with Surrogate Modeling                                                                                      | Prof. R. Sauer (coordinator)<br>Dr. B.T. Cao, Dr. G. Neu                          | 6                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-18                              | Problematic Soils                                                                                                                                      | Prof. T. Wichtmann (coordinator)<br>Dr. W. Baille                                 | 3                                                                                                                                                                                                                       | 3                                               | WiSe                         |
|                                                   |                                                                                                                                                                                                    | SE-O-14                              | Training of Competences (Part 1)                                                                                                                       |                                                                                   | 4                                                                                                                                                                                                                       | 1,2,3,4                                         | both                         |
|                                                   |                                                                                                                                                                                                    | SE-O-15                              | Training of Competences (Part 2)                                                                                                                       |                                                                                   | 4                                                                                                                                                                                                                       | 1,2,3,4                                         | both                         |
| Master Thesis: 30 CP                              |                                                                                                                                                                                                    | SE-MT                                | Master Thesis                                                                                                                                          | Professors, lecturers and assistants                                              | 30                                                                                                                                                                                                                      | 4                                               | SuSe                         |