Module Nr.	Credits	Workload	Semester	Frequency	Duration
SE-CO-12	10 CP	300 h	2	Yearly (SS)	1 semester
Courses			**Contact time**	**Self-study**	**Group size**
a) Reservoir Geophysics b) Rock Physics			3 h/week 3 h/week	120 h 90 h	According to demand; lab experiments in groups of max. 3 persons

Applied Geophysics

Learning outcomes

After successful completion of the module students

- appreciate the scale-dependent approach to the physical characterization of rocks (micro- to decimeter-scale) and reservoirs (deci- to kilometer-scale)
- understand the relation between physical properties of rocks and their chemical composition and microstructure
- learned the use and limits of empirical and theoretical concepts for the description of heterogeneous media
- know the practical aspects of a suite of methods in exploration geophysics
- are familiar with the mathematical description of physical processes on rock and reservoir scale
- understand the origin of the governing partial differential equations and master some approaches to their solution

Content

a) Reservoir geophysics (reservoir-scale perspective):

- Introduction to reservoirs (hydrocarbon, geothermal)
- Physical properties of reservoir fluids
- Hydraulic transport (Kozeny-Carman relation) and storage (linear poro-elasticity I: isostatic stress states)
- Theory and practice of pumping tests (diffusion equation, scaling)
- Geothermics (add advection to diffusion)
- Aspects of waves in real media (wave equation, linear poro-elasticity II: add deviatoric stresses)

b) Rock physics (grain-scale perspective)

- Introduction to rocks and minerals
- Porosity and interface phenomena
- Hydraulic transport in rocks (Darcy's law, permeability models)
- Elasticity (stress, strain, Hooke's law, averaging schemes)
- Failure of rocks (fracture and friction)
- Laboratory practical: students independently conduct simple experiments to determine basic physical properties of rocks (density, porosity, permeability, elastic wave velocities, electrical conductivity) and fluids (density, viscosity)

Teaching methods / Language

Lectures, assignments (deepening of contents through own research, solving of analytic and numerical problems), laboratory experiments / English
Mode of assessment Written final exam (3 hours) + report on lab experiments
Requirements for the award of credit points Passed module exam
Module applicability (in other study programs) -
Weight of the mark for the final score 8.33 %
Module coordinator and lecturer(s): Jörg Renner (coordinator)
Further information: Prerequisites: Sound mathematical skills (vector calculus, differential- and integral calculus) **Literature:** Jaeger, Cook, Zimmerman “Fundamentals of Rock Mechanics”; Gueguen, Palciauskas “Introduction to the physics of rocks“; Schön “Physical properties of rocks“; Mavko, Mukerji, Dvorkin “The rock physics handbook“; AGU reference shelf “Rock physics and phase relations“; Sully “Elements of petroleum geology”; Wang “Theory of linear poro-elasticity”; Fetter “Applied hydrogeology”; Zoback “Reservoir geomechanics”; Carcione “Wave-fields in real media”