CIVIL-428

Engineering geology for geo-energy

Nussbaum Christophe

Cursus	Sem.	Type
Civil Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Objective is to provide an understanding of the problems in geo-energy projects. Human induced fracturing has serious consequences in projects as conventional and unconventional hydrocarbon resources exploration, deep geothermal systems, CO2 storage and deep geological disposal of radioactive waste.

Content

We propose the following course outline:

- Structural geology, tectonics, in-situ stress, natural seismicity
- Methods of rock stress measurement, reliability and meaning of stress measurement, natural and excavation induced stress variation, borehole breakouts
- Borehole and gallery stability, rock mass discontinuities and anisotropy, role and development of pre-existing vs tunnel induced fractures, methods to characterize the excavation/borehole damage zone
- Application to deep geothermal systems
- Human induced fault reactivation, fault slip tendency, fracture propagation, induced seismicity
- Geological storage of CO2: well sealing integrity, caprock sealing integrity, fault sealing integrity

Keywords

structural geology, tectonics, natural and induced seiscimicity, stress measurements, borehole stability, hydraulic fracturing, deep geothermal systems, CO2 sequestration

Learning Prerequisites

Required courses

Soil mechanics, Geomechanics, Rock mechanics

Learning Outcomes

By the end of the course, the student must be able to:

- Construct a coherent geological model with the available data.
- Anticipate the rock mass and hydraulic perturbations for any subsurface projects (i.e. deep geothermal, CO2 storage, conventional and unconventional hydrocarbon resources exploration, construction of deep geological disposal for radioactive waste).
- Design the rock mass and hydraulic perturbations for any subsurface projects (i.e. deep geothermal, CO2 storage,

conventional and unconventional hydrocarbon resources exploration, construction of deep geological disposal for radioactive waste).

• Use correctly the acquired data in the project for building a coherent interpretation.

Transversal skills

• Access and evaluate appropriate sources of information.
• Continue to work through difficulties or initial failure to find optimal solutions.
• Demonstrate the capacity for critical thinking

Teaching methods

Ex cathedra
Slides powerpoint with the recommended reading : "Elements of Crustal Geomechanics" François Henri Cornet, May 2015

Expected student activities

attendance at lectures, completing exercices, reading selected scientific publications and doing a personal work

Assessment methods

The weighting is 50% for the written report and 50% for the oral defence in the form of a zoom meeting.

Resources

Bibliography

"Elements of Crustal Geomechanics", François Henri Cornet, May 2015

Ressources en bibliothèque

• Elements of crustal geomechanics / Cornet F.H.