unine
Université de Neuchâtel
Centre d'hydrogéologie
et géothermie

Continuing education at the University of Neuchâtel, Faculty of Science

Certificate of Advanced Studies

Exploration & Development of Deep Geothermal Systems (DEEGEOSYS)

6th Edition 2022-2023

General programme




Partners:

Schweizerische Eidgenossenschaft
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suisseénergie

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Continuing education at the University of Neuchâtel

CAS DEEGEOSYS: Exploration & Development of Deep Geothermal Systems

1. Introduction

Needs in geothermal education

Since 2009, a new Master's degree of Science in Hydrogeology and Geothermics began at the University of Neuchâtel, organized by the Centre for Hydrogeology and Geothermics (CHYN). This formation is geared toward students holding a Bsc degree and covers basics and advanced domains in hydrogeology and in geothermics.

As specialists are missing for exploration and exploitation of geothermal reservoirs in Switzerland and Europe, a continuing education programme in deep geothermal systems still corresponds to a real need.

Since 2011, a Certificate of Advanced Studies (CAS DEEGEOSYS) is available at the University of Neuchâtel. The 1st, 2nd, 3rd, 4th and 5th editions took place successfully in 2011-2012, 2013-2014, 2015-2016, 2018-2019, 2020-2021 with 15-25 participants per edition. This informative document gives a general overview of the program for the 6th edition taking place in 2022-2023.

Objectives

This Certificate of Advanced Studies (CAS DEEGEOSYS) is dedicated to train scientists and engineers in several fields of applied geothermics. They will be capable of planning, setting up and leading exploration and/or development projects related to deep geothermal resources (deep aquifer/hydrothermal systems and Enhanced Geothermal Systems - EGS).

2. Organization of the CAS DEEGEOSYS

Name

Certificate of Advanced Studies (CAS) in Deep Geothermal Systems (DEEGEOSYS).

Organizing institution

Centre for Hydrogeology and Geothermics (CHYN), Faculty of Science, University of Neuchâtel.

Venue

Centre for Hydrogeology and Geothermics (CHYN), Faculty of Science, University of Neuchâtel.

Participants

Earth scientists (geologists, geophysicists, hydrogeologists, geochemists), civil- or energy engineers, having a M.Sc. or an equivalent degree.

Training programme

The CAS DEEGEOSYS includes four one-week long modules separated by a two-month break. Each module covers a specific topic.

Module	Topic	ECTS
1	Geothermics and geophysics	2
2	Geochemistry and hydrochemistry	2
3	Drilling and logging	2
4	Reservoir evaluation and production	2
Technical report		2

The modules include courses given by international experts, exercises, visits of geothermal installations and exams.

At the end of the course, the participants will be required to write a technical report.

Technical report

Having followed 4 modules, the participants draft in a personal way a report on one of the themes studied during the CAS, supervised by one of the teachers. This technical report should take approximately 60 working hours and must be validated by the responsible teacher and the management of the CAS.

Credits ECTS (European Credit Transfer and Accumulation System)

The CAS DEEGEOSYS totalizes 10 ECTS: 2 ECTS per module (courses, exercises, examinations, technical visits) and 2 ECTS for the technical report.

Certificate

To be granted the certificate of the CAS, the participants have to achieve successfully the 4 modules, the exams and the technical report.

Fees

The fees include registration, administration, course material, social events and all activities during the modules, as well as the tutorial during the personal work (technical report).

Fee	Amount (CHF)
Application (no refund)	200
Administration	200
Four modules	4’400
Technical report	1’100
Grand total	5’900

The fees do not include transportation to and from Neuchâtel, accommodation and meals during the modules.

On inquiry and if there is enough place, participants who do not wish to follow the whole CAS, or to realize the technical report, can register separately for 1, 2 or 3 modules.

Fee to follow a single module (application and administration included): CHF 1'400.

Schedule

The 6th edition of the CAS DEEGEOSYS will start in September 2022.

Activity	Dates
Module 1	September 05 - 09, 2022
Module 2	November 07-11, 2022
Module 3	January 16-20, 2023
Module 4	March 13-17, 2023
Technical report deadline	May 31, 2023

Frequency

Annual to biennial: the training programme of the CAS must be completed within a single edition; on inquiry and by exceptional dispensation, it could be followed on two editions.

Attendance

The maximum number of participants is limited to 20, in order to facilitate the relations between the teachers and the participants, as well as the exercises in the computer room.

Language

The language of the CAS is English (lectures, hand-outs, exams, technical report).

The technical report at the end of course must be written in English, but on request, Swiss official languages (French, German and Italian) are potentially possible.

Lecturers

Main teachers: 6 to 7 international experts coming from various research institutes and/or from private companies from France, Iceland, Italy, Germany and Switzerland, give most lectures of the modules.

Additional teachers: 4 to 5 lecturers from Swiss laboratories and universities, teach some specific topics.

Rules

A separate document details all the aspects of the teaching and rules of the continuing education at the University of Neuchâtel.

Direction

- Dr. Reza Sohrabi (Director), CHYN, University of Neuchâtel
- Prof. Dr. Steve Miller, CHYN, University of Neuchâtel
- Prof. Dr. Benoît Valley, CHYN, University of Neuchâtel

Scientific Committee

A scientific committee will validate the structure and the contents of the modules and the programme of the CAS:

- Nicole Lupi, OFEN
- Laurent Scheurer, Groupe E

Information and registration

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More information and registration form on: http://www.unine.ch/cas-deegeosys

List of the lecturers

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Prof. Dr. Benoît Valley Centre d'Hydrogéologie et de Géothermie (CHYN) Université de Neuchâtel (UniNE) Rue Emile-Argand 11 CH-2000 Neuchâtel, Suisse benoit.valley@unine.ch www.unine.ch/chyn	**PD Dr. Christoph Wanner** University of Bern Institute of Geological Sciences Baltzerstrasse 3 CH-3012 Bern, Suisse christoph.wanner@geo.unibe.ch www.geo.unibe.ch/rwi

3. Courses plan

Module 1 Geothermics & Geophysics - September 05-09, 2022

Date and location	**Themes**	**Lecturer**
Monday 05 Room E326	Welcome and introduction of the CAS DEEGEOSYS	CAS Direction
	Geodynamics and Geothermics: theoretical basics World geothermal use	Steve Miller
	Geothermal uses Electricity production and energy conversion cycles Current and future development of geothermal energy use	Martin Saar
Tuesday 06 Room E326	Heat Equation Thermal processes	Steve Miller
	Earthquake Physics and Rock Mechanics The Basel EGS project case Heat production	Steve Miller
Wednesday 07 Room E326	Exploration : Geophysical methods	Steve Miller
	Exploration : Exercises on geophysical methods	Steve Miller
Thursday 08 Room E326	Exploration II: "Seismic to production" workflow: Data, concepts and methods in geothermal exploration	Ulrich Steiner
	Exploration II: Exercise (Petrel ™) to set up of a 3D model in the South German Molasse Basin	Ulrich Steiner
Friday 09 Travel	Visit of deep geothermal projects in the	Albert Genter
	Upper Rhine Graben geothermal play	Albert Genter

Module 2 – Geochemistry & Hydrochemistry – November 07-11, 2022

Date **Location**	**Themes**	**Lecturer**
Monday 07 Room TBD	Welcome and introduction of the Module 2	CAS Direction
	Fluid and mineral geochemistry, basics of thermodynamics, geochemistry of rocks and secondary minerals	Luigi Marini
	Exploration : Fluid geochemistry, origin of solutes, and water types Exploration : Fluid data interpretation, gas geochemistry	Luigi Marini
Tuesday 08 Room TBD	Exploration : Isotope geochemistry Exploration : Field surveys, sampling and measurements	Luigi Marini
	Reactive transport modelling of fluid-rock interactions in low and high temperature geothermal systems	Christoph Wanner
Wednesday 09 Room TBD	Exploration : Soil gas survey Exploration : Analyses, data quality and presentation Exploration : Chemical geothermometers	Luigi Marini
	Exercises on various geochemical problems (on PC)	Luigi Marini
Thursday 10 Room TBD	Exploration : Chemical and isotopic geothermometers Geochemical modelling of fluid-rock interactions	Luigi Marini
	Exercises on geochemical modelling (on PC)	Luigi Marini
Friday 11 Room TBD	Chemical stimulation, scaling and corrosion	Julia Scheiber
	Written examination of the Modules 1 & 2	CAS Direction

Module 3 – Drilling & Logging - January 16-20, 2023

Date **Location**	**Themes**	**Lecturer**
Monday 16 Room E326	Welcome and introduction of the Module 3	CAS Direction
	Generalities, basics of drilling technology Concept of exploration drilling	Sverrir Thorhallsson
	Drilling platform, rig types, waste handling, cementing Wells targeting, directional drilling	Sverrir Thorhallsson
Tuesday 17 Room E326	Drilling for high temperature reservoirs Design and completion for exploration and exploitation wells	Sverrir Thorhallsson
	Drilling cost and cost control, progress of the technology Use of drilling reports to assess the reservoir formation	Sverrir Thorhallsson
Wednesday 18 Room E326	Measurements while drilling (MWD), geo-monitoring parameters during drilling Safety questions, drilling incidents	Sverrir Thorhallsson
	Borehole logging	Benoît Valley
Thursday 19 Room E326	Case studies on borehole drilling	To be defined
Friday 20 Travel	Excursion related to deep borehole drilling	To be defined

Module 4 – Reservoir evaluation & Production – March 13-17, 2023

Date **Location**	**Themes**	**Lecturer**
Monday 13 Room TBD	Welcome and introduction of the Module 4	CAS Direction
	Introduction to reservoir engineering Pumping technology	Miklos Antics
	Equipment performance Monitoring programme, maintenance and life-time	Miklos Antics
Tuesday 14 Room TBD	Injection and production tests Effects of continuous fluid injection	Miklos Antics
	Simulation of reservoir exploitation	Miklos Antics
Wednesday 15 Room TBD	Reservoir stimulation I : Chemical methods Stimulation in carbonate reservoirs Economy and sustainable exploitation of deep reservoirs	Miklos Antics
	Case history of the Dogger reservoir of the Paris Basin Case history of Larderello geothermal field Introduction to induced seismicity Induced seismicity and Enhanced Geothermal Systems Lessons learned and future directions	Miklos Antics Steve Miller
Thursday 16 Room TBD	Methods in geothermal well testing (pumping, equipment) Design of hydraulic testing, examples Case studies in deep aquifer systems	Hansruedi Fisch
	Deep geothermal probes (>500m): theory and design Case studies related to deep geothermal probes: feedback from the La Plaine-du-Loup project, Lausanne, Switzerland	Niels Giroud
Friday 17 Room TBD	Written evaluation of Modules 3 + 4	CAS Direction
	Closing ceremony	

Technical report – Delivery date: May 31, 2023

Writing of the technical report by the participants	Supervision by the lecturers and the CAS Direction

REGISTRATION HERE:

http://www.unine.ch/cas-deegeosys