



Continuing Education at the University of Neuchâtel, Faculty of Science

Certificate of Advanced Studies (CAS)

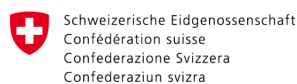
Exploration & Development of Deep Geothermal Systems (DeeGeoSys)

7th Edition 2024-2025

General Program



Partners:



Bundesamt für Energie BFE
Office fédéral de l'énergie OFEN
Ufficio federale dell'energia UFE



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 of Science (M.Sc.) 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 B.Sc. 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 program 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, 5th and 6th editions took place successfully in 2011-2012, 2013-2014, 2015-2016, 2018-2019, 2020-2021 and 2022-2023 with 10-20 participants per edition. This informative document gives a general overview of the program for the 7th edition taking place in 2024-2025.

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 Program

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.

All course materials will be delivered in PDF format instead of paper (hard copy). It is therefore essential to bring your own laptop during the lectures.

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)	250
Administration	350
Four Modules	5'000
Technical Report	1'300
Total	6'900

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 1'800.

Schedule

The 7th edition of the CAS DeeGeoSys will start in September 2024.

Activity	Dates
Module 1	September 02 - 06, 2024
Module 2	November 11-15, 2024
Module 3	January 20-24, 2025
Module 4	March 10-14, 2025
Technical Report deadline	May 31, 2025

Frequency

Annual to biennial: the training program 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 program of the CAS:

- Nicole Lupi, Swiss Federal Office of Energy (SFOE)
- Laurent Scheurer, Swiss Geological Survey / Swisstopo

Information and Registration

Mrs Corinne Carraux

Centre for Hydrogeology and Geothermics (Chyn)

University of Neuchâtel, Faculty of Science

Rue Emile-Argand 11, CH-2000 Neuchâtel, Switzerland

E-mail: cas.deegeosys@unine.ch

T +41 32 718 26 00

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

List of the Lecturers

<p>Dr. Miklos Antics GPC Instrumentation Process Paris Nord II, rue de la Belle Etoile - B.P. 55030 F-95946 Roissy CDG Cedex, France m.antics@geoproduction.fr www.gpc-france.com</p>	<p>Dr. Nicolas Clerc République et Canton de Genève Service de géologie, sols et déchets (GESDEC) Quai du Rhône 12, CH-1205 Genève nicolas.clerc@etat.ge.ch https://www.ge.ch</p>
<p>Dr. Albert Genter ES Géothermie 26b Président Wilson F-67000 Strasbourg, France albert.genter@es.fr www.geothermie.es.fr</p>	<p>Hansruedi Fisch AFRY Switzerland Ltd Herostrasse 12 CH-8048 Zürich hansruedi.fisch@afry.com www.afry.com</p>
<p>Prof. Dr. Luigi Marini STEAM srl via Ponte a Piglieri 8 I-56121 Pisa (PI), Italia luigimarini@rocketmail.com sites.google.com/view/luigimarini/home-page</p>	<p>Prof. Dr. Stephen A. Miller Université de Neuchâtel (UniNe) Centre d'Hydrogéologie et de Géothermie (CHYN) Rue Emile -Argand 11, CH-2000 Neuchâtel steve.miller@unine.ch www.unine.ch/chyn</p>
<p>François Penven Vallourec 12 Rue de la Verrerie 92190 Meudon, France francois.penven@vallourec.com www.vallourec.com</p>	<p>Prof. Dr. Martin O. Saar Department of Earth Sciences, ETH-Zurich Institute of Geophysics Sonneggstrasse 5, CH-8092 Zürich saarm@ethz.ch www.geg.ethz.ch</p>
<p>Dr. Julia Scheiber Bestec GmbH BismarckStr. 19 D-76870 Kandel, Deutschland scheiber@bestec-for-nature.com www.bestec-for-nature.com</p>	<p>Dr. Reza Sohrabi Groupe GRISONI Département de Géothermie Route de Saint-Marcel 17, CH-1373 Chavornay r.sohrabi@groupe-grisoni.ch www.groupe-grisoni.ch</p>
<p>Sverrir Thorhallson Iceland GeoSurvey (ISOR) Geothermal Engineering Dept. (Retired) Granaskjol 26, 107 Reykjavík, Iceland sverrir.thorhallsson@gmail.com www.geothermal.is</p>	<p>Prof. Dr. Benoît Valley Université de Neuchâtel (UniNe) Centre d'Hydrogéologie et de Géothermie (CHYN) Rue Emile-Argand 11, CH-2000 Neuchâtel benoit.valley@unine.ch www.unine.ch/chyn</p>
<p>PD Dr. Christoph Wanner University of Bern (UniBe) Institute of Geological Sciences Baltzerstrasse 3, CH-3012 Bern christoph.wanner@geo.unibe.ch www.geo.unibe.ch/rwi</p>	

3. Courses plan

Module 1: Geothermics & Geophysics, September 02.-06. 2024

Date and location	Themes	Lecturer
Monday 02 Room TBD	Welcome and introduction of CAS DeeGeoSys	CAS Direction
	Geodynamics and Geothermics: Theoretical basics and World geothermal use	Steve Miller
	Geothermal uses: Electricity production and energy conversion cycles Current and future development of geothermal energy	Martin Saar
Tuesday 03 Room TBD	Heat Equation Thermal processes	Steve Miller
	Earthquake Physics and Rock Mechanics The Basel EGS project case Heat production	
Wednesday 04 Room TBD	Exploration : Geophysical methods	Steve Miller
	Exploration : Exercises on geophysical methods	
Thursday 05 Room TBD	Exploration II: “Seismic to production” workflow: Data, concepts and methods in geothermal exploration Exploration II: How to set up a 3D geological model	Nicolas Clerc
	Road Trip to Alsace (France)	CAS Direction
Friday 06	Visit of deep geothermal projects in the Upper Rhine Graben geothermal play	Albert Genter
Sunday 15 September On line	Exam Module 1: Geothermics & Geophysics (18:00 – 19:30)	CAS Direction

Module 2: Geochemistry & Hydrochemistry, November 11.-15. 2024

Date Location	Themes	Lecturer
Monday 11 Room TBD	Welcome and introduction of 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	
Tuesday 12 Room TBD	Exploration : Isotope geochemistry Exploration : Field surveys, sampling and measurements	Luigi Marini
	Exploration : Soil gas survey Exploration : Analyses, data quality and presentation Exploration : Chemical geothermometers	
Wednesday 13 Room TBD	Exercises on various geochemical problems (on PC)	Luigi Marini
	Exploration : Chemical and isotopic geothermometers Geochemical modelling of fluid-rock interactions Exercises on geochemical modelling (on PC)	
Thursday 14 Room TBD	Insights from reactive transport modelling on low and high temperature geothermal systems	Christoph Wanner
Friday 15 Room TBD	Chemical stimulation, scaling and corrosion	Julia Scheiber

Sunday 24 March On line	Exam Module 2: Geochemistry & Hydrochemistry (18:00 – 19:30)	CAS Direction
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Module 3: Drilling & Logging, January 20.-24. 2025

Date Location	Themes	Lecturer
Monday 20 Room TBD	Welcome and introduction of Module 3	CAS Direction
	Generalities, basics of drilling technology Exploration and production drilling, HT/LT drilling	Sverrir Thorhallsson
	Well designs and completions Well targeting, directional drilling	
Tuesday 21 Room TBD	Rig types, drill sites, waste handling Drilling fluids and cementing Well control and safety questions	Sverrir Thorhallsson
	Monitoring drilling parameters, reporting Drilling problems Drilling cost, progress of the technology	
Wednesday 22 Room TBD	Well loads in Geothermal wells Casing standards and casing failure Geothermal close loop systems and specific tubulars	François Penven
	Borehole logging	Benoît Valley
Thursday 23 Room TBD	Case studies on deep borehole drilling	To be defined
Friday 24 Travel	Excursion related to deep borehole drilling	To be defined
Sunday 2 February On line	Exam Module 3: Drilling & Logging (18:00 – 19:30)	CAS Direction

Module 4: Reservoir Evaluation & Production, March 10.-14. 2025

Date Location	Themes	Lecturer
Monday 10 Room TBD	Welcome and introduction of Module 4	CAS Direction
	Introduction to reservoir engineering Pumping technology	Miklos Antics
	Equipment performance Monitoring program, maintenance and life-time	
Tuesday 11 Room TBD	Injection and production tests Effects of continuous fluid injection	Miklos Antics
	Simulation of reservoir exploitation Reservoir stimulation I: Chemical methods Stimulation in carbonate reservoirs Economy & sustainable exploitation of deep reservoirs Case history of the Dogger reservoir of the Paris Basin Case history of Larderello geothermal field	
Wednesday 12 Room TBD	Introduction to induced seismicity Induced seismicity and Enhanced Geothermal Systems Lessons learned and future directions	Steve Miller
Thursday 13 Room TBD	Methods in geothermal well testing (pumping, equipment)	Hansruedi Fisch
	Design of hydraulic testing, examples Case studies in deep aquifer systems	
Friday 14 Room TBD	Heat storage and deep geothermal probes (>500m) From drilling to operating	Reza Sohrabi
	Closing ceremony	CAS Direction

Sunday 23 March On line	Exam Module 4: Reservoir Evaluation & Production (18:00 – 19:30)	CAS Direction
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Technical report – Delivery date: May 31, 2025

Writing of the technical report by the participants	Supervision (Lecturers and CAS Direction)
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REGISTRATION HERE: <http://www.unine.ch/cas-deegeosys>