



Certificate of Advanced Studies

Exploration & Development of Deep Geothermal Systems – DEEGEOSYS

4th edition 2018-2019

General programme



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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. 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 and 3rd editions took place successfully in 2011-2012, 2013-2014, 2015-2016 with more than 20 participants per edition. This informative document gives a general overview of the program for the 4th edition, planned for 2018-2019.

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 of the University of Neuchâtel

Venue

Centre for Hydrogeology and Geothermics, Faculty of Sciences, 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): 1'400 CHF.

Schedule

The 4th edition of the CAS DEEGEOSYS will start in September 2018.

Activity	Dates
Module 1	September 10 - 14, 2018
Module 2	November 12 - 16, 2018
Module 3	January 14 - 18, 2019
Module 4	March 11 - 15, 2019
Technical report deadline	May 31, 2019

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 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 the rules of the continuing education at the University of Neuchâtel.

Organization

Centre for Hydrogeology and Geothermics – CHYN, University of Neuchâtel, Switzerland

Scientific Coordinator: Dr. Giona Preisig

Administrative Coordinator : Sabine Erb

Direction of the Course

- Prof. Steve Miller (director of the CAS), CHYN, Univ. of Neuchâtel
- Prof. Benoît Valley, CHYN, Univ. of Neuchâtel
- Dr. Giona Preisig (scientific coordinator of the CAS), CHYN, Univ. of Neuchâtel

Scientific Committee

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

- Prof. Pierre Perrochet, CHYN, Univ. of Neuchâtel
- Dr Laurent Tacher, Terreplus Sàrl (Bevaix)

Information and registration

University of Neuchâtel

Centre for Hydrogeology and Geothermics – CHYN

Mrs. Sabine Erb

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

Address

Centre for Hydrogeology and Geothermics – CHYN

University of Neuchâtel

Rue Emile-Argand 11

CH-2000 Neuchâtel, Switzerland+

List of the lecturers

<p>Dr. Miklos Antics GPC Instrumentation Process Paris Nord II, Immeuble Business Park, Bât. 4A 165, rue de la Belle Etoile - B.P. 55030 F-95946 Roissy CDG Cedex, France m.antics@geoproduction.fr <www.gpc-france.com></p>	<p>Hansruedi Fisch Nagra Hardstrasse 73 CH-5430 Wettingen, Switzerland hansruedi.fisch@nagra.ch <www.nagra.ch></p>
<p>Dr. Albert Genter ES Géothermie 3A chemin du Gaz F-67500 Haguenau, France albert.genter@es-groupe.fr <www.es-geothermie.fr></p>	<p>Dr. Luigi Marini Consultant in Applied Geochemistry via Antonio Fratti, 253 I-55049 Viareggio (LU), Italy luigimarini@rocketmail.com <www.appliedgeochemistry.it></p>
<p>Prof. Steve Miller Centre for Hydrogeology and Geothermics - CHYN Univ. de Neuchâtel Rue E.-Argand 11 CH-2000 Neuchâtel, Suisse Steve.miller@unine.ch <www.unine.ch/chyn></p>	<p>Prof. Martin Saar Institute of Geophysics Department of Earth Sciences ETH-Zurich Sonneggstrasse 5 CH-8092 Zurich, Switzerland saarm@ethz.ch <saarm@ethz.ch></p>
<p>Sverrir Thorhallson Iceland GeoSurvey Department Geothermal Engineering Grensásvegur 9 - 108 Reykjavík, Iceland s@isor.is <www.geothermal.is></p>	<p>Pierre Ungemach GPC Instrumentation Process Paris Nord II, Immeuble Business Park, Bât. 4A 165, rue de la Belle Etoile - B.P. 55030 F-95946 Roissy CDG Cedex, France pierre.ungemach@geoproduction.fr <www.gpc-france.com></p>
<p>Prof. Benoît Valley Centre for Hydrogeology and Geothermics - CHYN Univ. de Neuchâtel Rue E.-Argand 11 CH-2000 Neuchâtel, Suisse Benoit.valley@unine.ch <www.unine.ch/chyn></p>	<p>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></p>
<p>Ing. Francesco Barone Service industriels de Lausanne (SIL) Place Chauderon 23 CH-1003 Lausanne, Suisse</p>	<p>Dr. Julia Scheiber Bestech GmbH Oskar-von-Miller-Str. 2 D-76829 Landau scheiber@bestec-for-nature.com T +49 (6341) 94 96 4 - 21 <www.bestec-for-nature.com></p>

3. Preliminary courses plan

The preliminary course plan and the list of the lecturers are still submitted to possible changes.

Module 1 Geothermics & Geophysics - September 10- 14, 2018

Date and location	Themes	Lecturer
Monday 10 Room E326	Welcome and introduction of the CAS DEEGEOSYS Geodynamics and Geothermics: theoretical basics World geothermal use	CAS direction Steve Miller
	Geothermal uses Electricity production and energy conversion cycles Current and future development of geothermal energy use	Martin Saar
Tuesday 11 Room E326	Heat Equation Thermal processes	Steve Miller
	Earthquake Physics and Rock Mechanics The Basel EGS project case Heat production	
Wednesday 12 Room E326	Exploration : Geophysical methods	Steve Miller
	Exploration : Exercises on geophysical methods	
Thursday 13 Room E326	Exploration : Geological and geophysical methods for the development of conceptual models; 3D modelling: data, methods and softwares	Albert Genter
	Exploration : Fracture network and 3D models in the Rhine Graben; exercises	
Friday 14 Travel	Trip to Soultz-sous-Forêts/Rittershoffen, Alsace, France Presentation of the Soultz/Rittershoffen EGS project	Albert Genter
	Visit of the Rittershoffen EGS plant	

Module 2 – Geochemistry & Hydrochemistry - November 12 - 16, 2018

Date Location	Themes	Lecturer
Monday 12	Welcome and introduction of the Module 2 Fluid and mineral geochemistry, basics of thermodynamics, geochemistry of rocks and secondary minerals	CAS direction Luigi Marini
	Exploration : Fluid geochemistry, origin of solutes, and water types Exploration : Fluid data interpretation, gas geochemistry	Luigi Marini
Tuesday 13	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 14	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 15	Exploration : Chemical and isotopic geothermometers Geochemical modelling of fluid-rock interactions	Luigi Marini
	Exercises on geochemical modelling (on PC)	Luigi Marini
Friday 16	Chemical stimulation, scaling and corrosion	Julia Scheiber
	Written examination of the Modules 1 & 2	CAS direction

Module 3 – Drilling & Logging - January 14 - 18, 2019

Date Location	Themes	Lecturer
Monday 14	Welcome and introduction of the Module 3 Generalities, basics of drilling technology Concept of exploration drilling	CAS direction Sverrir Thorhallsson
	Drilling platform, rig types, waste handling, cementing Wells targeting, directional drilling	Sverrir Thorhallsson
Tuesday 15	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 16	Measurements while drilling (MWD), geo-monitoring parameters during drilling Safety questions, drilling incidents	Sverrir Thorhallsson
	Borehole logging	Benoît Valley
Thursday 17		
	Case studies on borehole drilling	To be defined
Friday 18 Travel	Excursion related to deep borehole drilling (to be defined)	To be defined

Module 4 – Reservoir evaluation & Production - March 11 - 15, 2019

Date Location	Themes	Lecturer
Monday 11	Welcome and introduction of the Module 4 Introduction to reservoir engineering Pumping technology	CAS direction Miklos Antics
	Equipment performance Monitoring programme, maintenance and life-time	Miklos Antics
Tuesday 12	Injection and production tests Effects of continuous fluid injection	Miklos Antics
	Simulation of reservoir exploitation	Miklos Antics
Wednesday 13	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	Miklos Antics
	Introduction to induced seismicity Induced seismicity and Enhanced Geothermal Systems Lessons learned and future directions	Steve Miller
Thursday 14	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	Francesco Barone
Friday 15	Written evaluation of Modules 3 + 4	CAS direction
	Closing ceremony	

Technical report – Delivery date: May 30, 2018

Writing of the technical report by the participants	Supervision by the lecturers and the CAS direction
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REGISTRATION TO INDIVIDUAL MODULES STILL POSSIBLE

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