



## **6.10.54E Implementing Provisions for the Master's Degree Program in Petroleum Engineering at Clausthal University of Technology, Faculty of Energy and Economic Sciences, of June 21, 2022**

**In the version of the 1<sup>st</sup> Amendment from 16 January 2024**

The Faculty of Energy and Economic Sciences adopted the following Implementing Provisions pursuant to section 7(3) read in conjunction with section 44(1) of the Lower Saxony Higher Education Act (Niedersächsisches Hochschulgesetz) on June 21, 2022. They were approved by the Presidential Board of Clausthal University of Technology on Tuesday, July 12, 2022 (Mitt.TUC 2022, p. 305). Last amended by the faculty board decree from 16 January 2024 and the authorisation from the chairmanship from February, 06, 2024.

### **Preamble**

The present Implementing Provisions shall apply only in connection with the General Examination Regulations of TU Clausthal as most recently amended and shall contain all supplementary rules and arrangements specific to the degree program.

### **Objective of the program of study**

The consecutive master's degree program in petroleum engineering is intended to give its graduates the skills, methodology, and knowledge required for a responsible occupation as an engineer in the geology-related energy sector. They are to be enabled to apply the skills they have gained in a wider economic, social and geopolitical context and to create technological solutions on the basis of critical analysis. In that context, the degree program is directed towards the acquisition not only of relevant technological and scientific foundations but also of key transferable qualifications and management skills in recognition of the rapid changes affecting that distinctly international sector. Alongside a well-founded and interdisciplinary understanding of science, this requires new, open and non-hierarchical ways of acquiring and communicating knowledge. A range of disciplines are, by their nature, already embedded in the petroleum engineering degree program, reflecting the broad spectrum from geology to heavy engineering and materials science to fluid dynamics, heat transfer and multiphase behavior, as well as non-technical and above all management-related skills. As a result, the students learn to think and communicate in interdisciplinary ways and to reflect on the impact of technological advances in light of social change. Their science- and technology-based as well as personal readiness for their chosen careers is developed in cumulative steps, building on foundations in natural sciences, engineering, business, and economics with a growing capacity for independent application (seminar work, group projects) and following up on particular interests (e.g.

through work as a student assistant), up to and including specialization (electives, master's thesis).

The university degree of Master of Science in Petroleum Engineering in either of the two strands – Reservoir Technologies or Drilling and Production Technologies – attests to the graduates' enhanced levels of science-based qualification for their professions and capacity for application-focused research, over and above those demonstrated by the B.Sc. degree. It thus confers on graduates an additional professional qualification.

In accordance with the international orientation of the consecutive program, the courses are offered in English.

### **Ad section 5 Program-specific Implementing Provisions**

The master's program in petroleum engineering shall be modular in structure. The credit points allocated to each module under the European Credit Transfer System (ECTS) as well as the nature and scope of the required pieces of learning and assessment work shall be set out in Annex 1 (Module overview) to the present Provisions.

The following strands shall be available to choose from, each student being required to select exactly one of them:

- a. Reservoir Technologies
- b. Drilling and Production Technologies

Annexes 2a and 2b shall each contain a model program schedule for each strand showing the recommended structure of the degree program.

A detailed description of the modules and in-depth information on the contents shall be made available in the separate module handbook.

### **Ad section 6 Duration and structure of the degree program, assessment**

Students can begin the degree program only in the winter semester.

The standard duration of the master's degree program in full-time study, including the master's thesis, shall be four semesters. The degree program shall comprise 120 credit points, of which 28 credit points shall be for the master's thesis including the colloquium.

It is recommended that any student who acquired their bachelor's degree from a German university complete one semester (preferably the third or fourth of the program) as a semester abroad, preferably at a partner university, or a placement abroad. They must agree the pieces of learning and assessment work to be completed with their program advisor beforehand and have them approved in the form of a Learning Agreement.

## **Ad section 10**

### **Admission to examinations**

A student's first attempt at an examination in any module belonging to one strand shall render their choice of strand binding. A change of strands shall only be permissible if no examination attempt within a module has yet been undertaken or is considered undertaken. It shall be permissible to switch once, and a written application for the switch must be submitted to the Examinations Office in good time, before the newly chosen module from the other strand is taken.

A student's first attempt at an examination in an elective module shall render their choice of module binding. A change of elective modules shall only be possible if no examination attempt in an elective module has yet been undertaken or is considered undertaken.

## **Ad section 13**

### **Structure of examinations, supplementary examinations, and examinations required to fulfill conditions**

The master's examination shall consist of the module and/or module-component examinations of the compulsory and elective modules as specified in Annex 1 and a master's thesis as specified in section 16 of the General Examination Regulations.

Catalogues of elective modules from Annex 1 can be updated once a year by Faculty Board decision. If changes are made to the catalogues of elective modules, they shall be published for each academic year via the Student Center by the end of the previous August, and any changes for the summer semester, which can be made in exceptional circumstances, shall be published by the end of the previous February here:

<https://www.tu-clausthal.de/studieninteressierte/studiengaenge/master-studiengaenge/petroleum-engineering>

All courses shall be held in English. All written and oral examinations shall be held in English.

## **Ad section 14**

### **Forms of learning and assessment work**

The form of required pieces of learning and assessment work shall be set out in Annex 1 (Module overview). If different forms of assessment can be required depending on examiners' choice, each examiner shall, in the first class of each course, detail and make known to the students the possible forms of assessment and, if applicable, permitted support tools specified in Annex 1. For written and oral examinations, (cf. section 15(3) and (4) of the General Examination Regulations), the examination duration shall be laid down in the module handbook.

The group project module shall train students in interdisciplinary cooperation on the basis of a practice-based problem. The choice of topic shall be aligned with one of the main divisions within the focus areas of the program, such as a field development plan involving at least four students in each group. In a field development study, using, for example, real

data from a mineral deposit, students shall work through the steps required for geophysical exploration and evaluation of the deposit, planning of drilling operations, geological modeling, production forecasting, design of the surface and underground load conveyor systems, cost-benefit analysis, economic assessment of the project, and transport of the products. The work should take between 6 and a maximum of 8 weeks. Participating in the soft skills module shall prepare students for the interdisciplinary cooperation required for their work. Each group shall be assigned at least one university teacher as a mentor. The results of the project shall be submitted in writing, assessed, and presented by the group in a joint presentation in the context of a seminar. The contribution of each person to be assessed must be clearly differentiated on the basis of sections, page numbers, or other objective criteria, be separately assessable, and correspond to the requirements specified in section 14 of the General Examination Regulations. The work of the group and each candidate's contribution is assessed by the teacher specializing in the topic of the group project.

### **Ad section 16 Final thesis**

The master's thesis, including the colloquium, shall comprise 28 credit points and shall be completed within a timeframe of five months.

Upon application to the Examinations Committee and with the endorsement of the first assessor, that timeframe can be extended in exceptional circumstances to a total of six months.

Separate admission in accordance with section 10 of the General Examination Regulations shall be required for the master's thesis. The first assessor shall be named in the application for that admission.

The examiner must be from the group of university teachers of TU Clausthal, and his or her institute must be specified below:

- Institute of Subsurface Energy Systems

Justified exceptions can be made upon application to the Examinations Committee.

Admission to the master's thesis shall be granted to applicants who, in addition to the prerequisites specified in section 10 of the General Examination Regulations, have accumulated at least 80 credit points. Justified exceptions can be made upon application to the Examinations Committee.

The grade for the master's thesis as a module examination shall be comprised of 90% for the written element and 10% for the oral element (colloquium).

## **Ad section 18**

### **Evaluation of assessment work, calculation of grades**

The weighting ascribed to each module when calculating the overall grade for the master's examination shall be set out in Annex 1 (Module overview).

## **Ad section 22**

### **Non-completion, cheating, exceptions**

The master's degree program in petroleum engineering shall not be suitable for part-time study.

## **Ad section 33**

### **Entry into force**

The present Implementing Provisions shall enter into force on the day following their publication in the official journal of Clausthal University of Technology, the Amtliches Verkündungsblatt, for the beginning of the 2022/2023 winter semester examination period.

### **Transitional provisions concerning the present Implementing Provisions of June 21, 2022**

Students who begin this degree program at TU Clausthal from the 2022/2023 winter semester onwards shall be examined in accordance with the present Implementing Provisions.

Students who are in their second or higher semester in this degree program when the present Implementing Provisions enter into force can complete the program in accordance with the Implementing Provisions for the Master's Degree Program in Petroleum Engineering of July 21, 2015, as most recently amended until the end of the 2025 summer semester examination period. A switch to the present Implementing Provisions shall be permissible upon application. That application must be lodged with the Examinations Committee no later than the student's admission to undertake a master's thesis.

### **Transitional provisions to the 1st amendment dated 16.01.2024**

(1) Students who start studying this course of study from the winter semester 2024/2025 will be examined according to this version of the implementing regulations.

(2) Students who were already enrolled in this course of study according to the implementing regulations of June 21, 2022 before the winter semester 2024/2025 will be transferred to this version of the implementing regulations.

## Annex 1: Module overview for the master's degree program in petroleum engineering

<b>General compulsory modules for both strands</b>							
All the modules listed below, totaling 62 credit points, must be completed.							
Module or course title	Course number	Course type hrs/week	Credit points	Exam form	Weighting	Graded?	Assessment type
Module: Soft Skills		4	4		4/Σcredit points		
Interpersonal Skills	S 6111	2L	2	W/O	0.5	yes	MCE
Technical Writing	W 9009	2T	2	ThA	0.5	yes	MCE
Module: Reservoir Management, Economics and Law		7	8		8/Σcredit points		
Field Management and Surveillance	W 6166	1L+1T	2	W/O	0.25	yes	MCE
Health, Safety and Environmental Management	W 6135	1L	2	W/O	0.25	yes	MCE
Planning and Budgeting	W 6114	2L	2	W/O	0.25	yes	MCE
Energy Law	S 6168	2L	2	W/O	0.25	yes	MCE
Module: Fluid Phase and Flow Behaviour		8	10		10/Σcredit points		
Applied Thermodynamics & Phase Behavior of Hydrocarbons	W 6104	2L+1T	4	W/O	1	yes	ME
Advanced Fluid Properties	W 6164	1L+1T	3				
Numerical Fluid Mechanics	W 8035	2L+1T	3				
Module: Group Project		6	12		12/Σcredit points		
Group Project	W 6171	6T	12	PA	1	yes	ME
Module: Master's Thesis			28		28/Σcredit points		
Master's Thesis + Presentation		5 months	28	FT	1	yes	ME
<b>Choice of electives for both strands</b>							
<ul style="list-style-type: none"> <li>Modules amounting to <u>exactly 24 credit points</u> must be selected from electives catalogue A "Reservoir Technologies" or electives catalogue B "Drilling and Production Technologies" or electives catalogue C "Interdisciplinary" and successfully completed. Additional examinations can only be undertaken as supplementary examinations.</li> <li>A student's first attempt at an examination in an elective module shall render their choice of module binding. A change of elective modules shall only be possible if no examination attempt in an elective module has yet been undertaken or is considered undertaken.</li> </ul>							

## Strands:

### Strand: Reservoir Technologies

- Each student must choose exactly one strand.
- Their first attempt at an examination in any module belonging to one strand shall render their choice of strand binding. A change of strands shall only be permissible if no examination attempt within a module has yet been undertaken or is considered undertaken. It shall be permissible to switch once, and a written application for the switch must be submitted to the Examinations Office in good time, before the newly chosen module from the other strand is taken.

### Compulsory modules for Reservoir Technologies

All the modules listed below, totaling 22 credit points, must be completed.

Module or course title	Course number	Course type hrs/week	Credit points	Exam form	Weighting	Graded?	Asses. type
Module: Reservoir Modeling and Simulation		7	10		<b>10/Σcredit points</b>		
Geological Modeling	W 4820	1L+1T	3	W/O	1	yes	ME
Fundamentals of Reservoir Simulation	S 6102	2L	4				
Reservoir Simulation Workshop	S 6165	3T	3				
Module: Lab and Measurements		4	6		<b>6/Σcredit points</b>		
Applied Well Test Analysis	S 6109	1L+1T	3	W/O	0.5	yes	MCE
Laboratory Measurement Techniques (Core Flooding/Micro Fluidics/SCAL)	W 6139	1L+1T	3	W/O	0.5	yes	MCE
Module: Seminar		4	6		<b>6/Σcredit points</b>		
Reservoir Research Project	S 6161	4S	6	SC	1	yes	ME

### Choice of electives for Reservoir Technologies

- Modules amounting to exactly 12 credit points must be selected from electives catalogue A “Reservoir Technologies” and successfully completed. Additional examinations can only be undertaken as supplementary examinations.
- A student’s first attempt at an examination in an elective module shall render their choice of module binding. A change of elective modules shall only be possible if no examination attempt in an elective module has yet been undertaken or is considered undertaken.

## Strand: Drilling and Production Technologies

- Each student must choose exactly one strand.
- Their first attempt at an examination in any module belonging to one strand shall render their choice of strand binding. A change of strands shall only be permissible if no examination attempt within a module has yet been undertaken or is considered undertaken. It shall be permissible to switch once, and a written application for the switch must be submitted to the Examinations Office in good time, before the newly chosen module from the other strand is taken.

### Compulsory modules for Drilling and Production Technologies

All the modules listed below, totaling 22 credit points, must be completed.

Module or course title	Course number	Course type hrs/week	Credit points	Exam form	Weighting	Graded?	Asses. type
Module: Advanced Production and Processing		5	8		<b>8/Σcredit points</b>		ME
Advanced Production (including EP)	W 6131	2L+1T	5	W/O	1	yes	ME
Advanced Hydrocarbon Conditioning and Processing	S 6110	2L	3				
Module: Drilling and Completion		5	8		<b>8/Σcredit points</b>		
Completion and Workover	S 6121	2L+1T	5	W/O	0.625	yes	MCE
Directional Drilling	S 6125	2L	3	W/O	0.375	yes	MCE
Module: Seminar		4	6		<b>6/Σcredit points</b>		
Drilling and Production Research Project	S 6162	4S	6	SC	1	yes	ME

### Choice of electives for Drilling and Production Technologies

- Modules amounting to exactly 12 credit points must be selected from electives catalogue B “Drilling and Production Technologies” and successfully completed. Additional examinations can only be undertaken as supplementary examinations.
- A student’s first attempt at an examination in an elective module shall render their choice of module binding. A change of elective modules shall only be possible if no examination attempt in an elective module has yet been undertaken or is considered undertaken.



## Catalogues of elective modules:

### Electives catalogue A “Reservoir Technologies”

The list of modules offered can be updated annually (as of [semester]) for the subsequent academic year by Faculty Board decision. The updated lists shall be published throughout the university by the Student Center:

<https://www.tu-clausthal.de/studieninteressierte/studiengaenge/master-studiengaenge/petroleum-engineering>

Module or course title	Course number	Course type hrs/week	Credit points	Exam form	Weighting	Graded?	Asses . type
Module: Reservoir Engineering		7	12		<b>12/Σcredit points</b>		
Equation of State Fluid Characterisation	W 6156	1L + 2T	4	W/O	1/3	yes	MCE
Enhanced Oil Recovery	W 6103	2L	4	W/O	1/3	yes	MCE
Underground Storage of Energy and Gases	S 6113	2L	4	W/O	1/3	yes	MCE
Module: Advanced Reservoir Modeling		7	12		<b>12/Σcredit points</b>		
Reservoir Model Validation	S 6103	2L	4	W/O	1/3	yes	MCE
Advanced Rock Physics	W 6118	1L + 1T	4	W/O	1/3	yes	MCE
Advanced Geostatistics	W 4635	2L+1T	4	W/O	1/3	yes	MCE

### Electives catalogue B “Drilling and Production Technologies”

The list of modules offered can be updated annually (as of [semester]) for the subsequent academic year by Faculty Board decision. The updated lists shall be published throughout the university by the Student Center:

<https://www.tu-clausthal.de/studieninteressierte/studiengaenge/master-studiengaenge/petroleum-engineering>

Module or course title	Course number	Course type hrs/week	Credit points	Exam form	Weighting	Graded?	Asses . type
Module: Drilling and Production Engineering		8	12		<b>12/Σcredit points</b>		
Rock Mechanics in Subsurface Energy Systems	W 6234	2L+1T	4	W/O	1/3	yes	MCE
Materials Engineering and Corrosion	S 6117	2L	4	W/O	1/3	yes	MCE
Well Planning	W 6105	2L+1T	4	W/O	1/3	yes	MCE
Module: Digital Drilling and Monitoring		9	12		<b>12/Σcredit points</b>		
Advanced Drilling Technology	W 6122	2L+1T	4	W/O	1/3	yes	MCE
Digital Drilling Lab	S 6185	1L + 2T	4	W/O	1/3	yes	MCE
Digital Transformation in Oil & Gas	W 6186	2L+1T	4	W/O	1/3	yes	MCE

## Electives catalogue C “Interdisciplinary”

The list of modules offered can be updated annually (as of [semester]) for the subsequent academic year by Faculty Board decision. The updated lists shall be published throughout the university by the Student Center:

<https://www.tu-clausthal.de/studieninteressierte/studiengaenge/master-studiengaenge/petroleum-engineering>

Module or course title	Course number	Course type hrs/week	Credits	Exam form	Weighting	Graded?	Asses. type
Module: Geosciences		9	12		<b>12/Σcredit points</b>		
Petrophysics I	W 4021	2L+1T	4	W/O	1/3	yes	MCE
Applied Seismic Data Interpretation	S 4008	2L+1T	4	W/O	1/3	yes	MCE
Well Logging II	S 4023	2L+1T	4	W/O	1/3	yes	MCE
Module: Geothermal Systems		6	12		<b>12/Σcredit points</b>		
Geothermal Geology	W 4660	1L + 1T	4	W/O	1	yes	ME
Enhanced Geothermal Systems	S 6149	2L	4				
Geothermal Energy Production Systems	W 6150	2L	4				
Module: Complex Fluid Systems		8	12		<b>12/Σcredit points</b>		
Applied Rheology	W 6126	2L+1T	4	W/O	1/3	yes	MCE
Complex Fluids-Flow and Transport Processes in Porous Media	S 6129	2L	4	W/O	1/3	yes	MCE
Advanced Reservoir Simulation with Complex Fluids	W 6128	1L + 2T	4	W/O	1/3	yes	MCE

**Key:**

(1) Types of course	E	excursion
	lab	laboratory class
	S	seminar
	PT	peer tutorial
	L	lecture
	T	tutorial
(2) Forms of examination		W written exam
	O	oral exam
	SC	seminar contribution
	PrA	practical assignment
	ThA	theory assignment
	RA	research assignment
	PA	project assignment
	IP	industrial placement
	HA	home assignments
	Ex	excursions
	FT	final thesis
(3) Types of assessment:		FA formative assessment
	ME	module examination
	MCE	module-component examination
	EP	examination prerequisites
(4) Other abbreviations		
	exam	examination
	ECTS	European Credit Transfer System
	hrs/wk	class hours per week

## Annex 2a: Model Program Schedule for the Master's Degree in Petroleum Engineering – Reservoir Technologies Strand (starting in the winter semester)

\_Implementing Provisions June 21, 2022

hrs/ wk	1st semester (WS)	2nd semester (SS)	3rd semester (WS)	4th semester (SS)
1	Technical Writing 2 credit points	Interpersonal Skills 2 credit points	Field Management and Surveillance 2 credit points	Energy Law 2 credit points
2				
3	Applied Thermodynamics & Phase Behavior of Hydrocarbons 4 credit points	Fundamentals of Reservoir Simulation 4 credit points	Planning and Budgeting 2 credit points	Master's Thesis + Presentation 28 credit points
4		Reservoir Simulation Workshop 3 credit points	Health, Safety and Environmental Management 2 credit points	
5				
6	Numerical Fluid Mechanics 3 credit points	Reservoir Research Project 6 credit points	Group Project 12 credit points	
7				
8				
9	Advanced Fluid Properties 3 credit points	Reservoir Research Project 6 credit points	Group Project 12 credit points	
10				
11	Geological Modeling 3 credit points	Applied Well Test Analysis 3 credit points	Elective A: Reservoir Technologies	
12				
13	Laboratory Measurement Techniques 3 credit points	Elective A: Reservoir Technologies 4 credit points	Elective A or B or C 4 credit points	
14				
15	Elective A: Reservoir Technologies 4 credit points	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	
16				
17	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	
18				
19				
20	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	
21				
22	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	
23				
Σ hrs/w k	22	21	19	20
Σ credit points	30	30	30	30

**Annex 2b: Model Program Schedule for the Master’s Degree in Petroleum Engineering – Drilling and Production Technologies Strand (starting in the winter semester) \_Implementing Provisions June 21, 2022**

hrs/ wk	1st semester (WS)	2nd semester (SS)	3rd semester (WS)	4th semester (SS)
1	Technical Writing 2 credit points	Interpersonal Skills 2 credit points	Field Management and Surveillance 2 credit points	Energy Law 2 credit points
2				
3	Applied Thermodynamics & Phase Behavior of Hydrocarbons 4 credit points	Advanced Hydrocarbon Conditioning and Processing 3 credit points	Planning and Budgeting 2 credit points	Master’s Thesis + Presentation 28 credit points
4		Completion and Workover 5 credit points		
5				
6	Numerical Fluid Mechanics 3 credit points		Group Project 12 credit points	
7				
8				
9	Advanced Fluid Properties 3 credit points	Directional Drilling 3 credit points	Elective B: Drilling and Production Technologies 4 credit points	
10				
11	Advanced Production 5 credit points	Drilling and Production Research Project 6 credit points	Elective A or B or C 4 credit points	
12				
13				
14				
15	Elective B: Drilling and Production Technologies 4 credit points	Elective B: Drilling and Production Technologies 4 credit points	Elective A or B or C 4 credit points	
16				
17				
18	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points	
19				
20				
21	Elective A or B or C 4 credit points	Elective A or B or C 4 credit points		
22				
23				
Σ hrs/w k	22	23	19	20
Σ credit points	29	31	30	30