Course title: Fluid and Gas Reservoir Engineering and Drilling Technologies

Course number: 541-0021

Supervising institute: Institute of Geological Engineering

Course guarantee: prof. Ing. Petr Bujok, CSc.

Credits: 4 Duty: compulsory

Level of study: undergraduate Teaching language: Czech

Year: 3 Semester: winter

Link to website:

Intended for faculties: HGF Intended for the type of study: bachelor

Way of completion: credit and examination Hours per week: 2+2

Prerequisites: none Co-requisites: none

Appears in prerequisites: no

Learning outcomes

- The student demonstrates knowledge:
  - in fundamentals of the extraction of liquids and gases;
  - in fundamentals of the equipment / rigging for extractive probes;
  - in fundamentals of the technology of drilling deep and very deep wells;

- The student can:
  - describe the geological characteristics of the mined horizon;
  - propose how to increase the yield of deposits;
  - determine the parameters of the equipment / rigging for extractive probes;

- The student is able to:
  - propose a mode of extraction;
  - define suitable parameters of drilling rigs;
  - calculate the expected production of liquids and gases;
Teaching methods (representation of individual methods must be quantified in %)

- Lectures – 35%
- Exercises – 35%
- Individual work – 30%

Annotation

The course aims to teach students how to characterize and describe the various technologies and technical means used in the extraction of gases and fluids and in drilling wells for oil and natural gas, as well as the extraction of coalbed methane (CBM), shale gas (ShaleGas) and others. Students must be able to explain the principles of these technologies and illustrate the field of their application through practical examples. Students learn to apply and use the theoretical knowledge in the field of mining and drilling, and practise this knowledge in calculation exercises as well as during professional short-term excursions. They must be able to assess the assigned tasks in the exercises, analyze them and find appropriate solutions presented in the form of papers and presentations. Last but not least, the students should learn to assess the significance of the information received during their studies, summarize the respective data, compare them and choose those that are essential for their further professional growth.

Compulsory literature


Recommended reading


SPEDrilling&Completion – professional journal available in teachers.

Requirements for providing the education

Class-rooms / theatres should be equipped with computers and data projectors.
Methods of continuous checking knowledge during the semester

During the semester, knowledge is checked by solving individual computational and laboratory tasks in the exercises. Professional language competence is checked by working with professional English texts.

Outline of lectures

1) Disintegration of rocks in drilling wells
2) Methods in deep drilling and types of wells
3) Technique for performing drilling work
4) Drilling tools
5) Drilling and casing shaft
6) Cementing wells
7) Management of drilling fluids
8) Failures in the well and accidents
9) Equipment of probes designed for the extraction of liquids and gases
10) Petrophysical properties of hydrocarbon deposits
11) Fundamentals of oil engineering
12) Technology of production of hydrocarbons
13) Increasing the yield of hydrocarbon deposits (EOR methods)
14) The issue of hydraulic fracturing
15) Extraction of unconventional hydrocarbon deposits (ShaleGas, TightGas, OilSands, etc.)
16) Coalbed methane extraction by drilling wells (CBM)

Outline of exercises

1) Work with professional English text – all-semester task → understanding the selected article and subsequent presentation
2) 6 computational exercises - basic calculations in the well trajectory, splitting gradients, velocity of circulation and the required density of the drilling fluid, analysis of the hydraulics of designed well, probes mortification, sizing of hydrocarbon extraction
3) Laboratory exercises (laboratory for stimulating wells and hydrocarbon deposits) - working with automated permeameters and porosimeters, one-phase and two-phase permeameters, capillarimeters.

Exam question topics

1) The work of the working bodies of drilling tools
2) Expressing the disintegration of rocks in drilling
3) Purposes of deep drilling and types of wells
4) Methods of executing deep wells
5) Drilling equipment for heavy drilling rigs
6) The main functional units of drilling rigs
7) Basic parameters of drilling rigs
8) Division of drilling rigs
9) Drilling rigs for core-drilling
10) Drilling rigs for full-profile rotary drilling
11) Classification of drilling tools
12) Functional composition of drilling shafts, assembles of drilling shafts and work of drilling shafts in the well
13) Casing shafts – structure, composition, technology of casing
14) Cementing wells – cements and their properties, cementation methods
15) The function of drilling fluids in the well
16) Types of drilling fluids and their rheological properties
17) The causes of accidents in the well, the types of accidents and their settlement
18) Oil and gas deposits – formation, types of deposits, localization of deposits, economy
19) Properties of oil and natural gas
20) Capacity of oil and gas deposits
21) Properties of reservoir rocks (porosity, permeability, one-phase and two-phase liquids)
22) Equipment / rigging of probes for oil and natural gas
23) Ground technology required for the exploitation of hydrocarbon deposits
24) Conventional extracting methods for hydrocarbon deposits
25) Secondary and tertiary extractive methods (Enhanced Oil Recovery)
26) Increasing the yield of hydrocarbon deposits – acidizing
27) Increasing the yield of hydrocarbon deposits – hydraulic fracturing
28) Non-conventional sources of hydrocarbon deposits – types, global localization, geological conditions
29) Non-conventional sources of hydrocarbon deposits – methods of extraction
30) Features and conditions of coalbed methane extraction
31) Technology of methane extraction

**Terms for completing the course**

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<th>Task name</th>
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