



RESERVOIR GEOLOGY AND MODELLING

Petroleum Geoscience Engineer MSc

2020/21. I. Semester

COURSE COMMUNICATION FOLDER

**University of Miskolc
Faculty of Earth Science and Engineering
Institute of Mineralogy and Geology**

Course Title: Reservoir geology and modeling

Credits: 3

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **lec. 2, sem. 1**

Neptun code: MFFAT730002

Type of Assessment(exam. / pr. mark. / other):**exam**

Grading limits:

>80%: excellent,
70-80%: good,
60-70%: medium,
50-60%: satisfactory,
<50%: unsatisfactory.

Position in Curriculum (which semester): **third**

Pre-requisites (*if any*):

Course Description:

Acquired store of learning:

Study goals:Reservoir geology is a fundamental skill to integrate data from various disciplines at different scales from the exploration to the production of oil and gas. Through 3D modelling and visualisation packages high-resolution models but require well trained professionals with good command on the basics and on manual skills of core-, log-, test evaluation and mapping procedures to properly select input and to understand and validate output data (QC).

Course content:Introduction – aims and role of integrated reservoir management in the upstream value chain.Reservoir Geology – why is it a fundamental component in reservoir management?Phases in Reservoir Geology: from operative plans to strategic vision.Consistency and coherency: key elements of understanding our reservoirs properly. Duties of geoscientists and engineers. Analysis of Reservoir Rocks – the only source of direct measurements and observations. Cores and core description. Lithology, facies and facies groups, lithostratigraphy. Depositional and diagenetic history: main factors controlling reservoir heterogeneity. Conventional (CCAL) and special core analysis (SCAL): elements connecting static and dynamic models. Determination of reservoir geometry – steps to determine reservoir bulk rock volume (BRV). Stratigraphic correlation panels: zonation of stratigraphic sequences. Tectono-stratigraphic charts: summarising stratigraphic units and hiatus. Structural cross sections: determination and visualisation of structural elements. Reservoir zonation: determining and visualising reservoir complexity as the main element controlling subsurface fluid flow. Determination of Pay Rock Volume (PRV). Tectonic/structural implications controlling the spatial extension of reservoir rock(s). Lithological and petrophysical implications controlling reservoir rock heterogeneity and subsurface flow. Definition of fluid contact

types. Vertical delineation of PRV: practical determination of oil/water and gas/oil contacts. Visualisation of hydrocarbon saturation distribution: contact charts and saturation profiles. Reservoir geological (static) model and volumetric determination of Petroleum Initially - in - Place (PIIP). Selection, acquisition, integrated validation and management of subsurface data for calculating PIIP. Assessment of uncertainties in delineation of pay rock volume. Mapping reservoir structure, gross and net thickness, and reservoir properties. Rules of determining and mapping reservoir thickness values. Principles of mapping reservoir parameters. Steps of building a high resolution 3-D model. Feedback from dynamic model and field performance data to upgrade the static model. Resource – reserves categorization (terms and definitions; classification/categorization systems, SEC and SPE-PRMS, UNFC as most frequently used systems; challenges and responses).

Education method:

Competencies to evolve:

T1, T2, T4, T5, T6, T7, T8, T9, T10, T12, K3, K4, K5, K6, K7, K8, K9, K10, K11, A1

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources:**

- István BÉRCZI: Development Geology, HOT Engineering, 2009. 480p.
- CATAPANG, Timothy John: Basic Petroleum Geology.
- SELLEY, R. C.: Elements of Petroleum Geology.
- University of Texas: Petroleum Geology & Reservoirs, www.utexas.edu.
- Ashton, Michael: Advances in reservoir geology. The Geological Society, 1992 - 240 p.
- Hocott, C. R.: Basic reservoir engineering for geologists., The Geological Society, 1978 - 42 p.

Responsible Instructor(*name, position, scientific degree*):

Viktor Mádai Dr., associate professor, PhD

Syllabus of the semester

Tuesday, 14:00 – 17:00

<i>Date</i>	<i>Lecture</i>	<i>Practical</i>
2020.09.08.	Introduction – aims and role of integrated reservoir management in the upstream value chain.	Overview, Introduction, basic requirements
2020.09.15.	Reservoir Geology – why is it a fundamental component in reservoir management? Phases in Reservoir Geology: from operative plans to strategic vision. Consistency and coherency: key elements of understanding our reservoirs properly	COGEH Reserve Classifications, Volumetric Estimations
2020.09.22.	Duties of geoscientists and engineers. Analysis of Reservoir Rocks – the only source of direct measurements and observations	Decline Analysis
2020.09.29.	Cores and core description. Lithology, facies and facies groups, lithostratigraphy. Depositional and diagenetic history: main factors controlling reservoir heterogeneity. Conventional (CCAL) and special core analysis (SCAL): elements connecting static and dynamic models	Material Balance Analysis
2020.10.06.	Determination of reservoir geometry – steps to determine reservoir bulk rock volume (BRV). Stratigraphic correlation panels: zonation of stratigraphic sequences. Tectono-stratigraphic charts: summarising stratigraphic units and hiatus	Material Balance for Oil Reservoirs
2020.10.13.	Structural cross sections: determination and visualisation of structural elements. Reservoir zonation: determining and visualising reservoir complexity as the main element controlling subsurface fluid flow	Well Test Interpretation
2020.10.20.	Determination of Pay Rock Volume (PRV). Tectonic/structural implications controlling the spatial extension of reservoir rock(s). Lithological and petrophysical implications controlling reservoir rock heterogeneity and subsurface flow.	Rate Transient Analysis
2020.10.27.	Definition of fluid contact types. Vertical delineation of PRV: practical determination of oil/water and gas/oil contacts	Rate Transient Analysis
2020.11.03.	Visualisation of hydrocarbon saturation distribution: contact charts and saturation profiles	Monte Carlo Simulation
2020.11.10.	Reservoir geological (static) model and volumetric determination of Petroleum Initially - in - Place (PIIP).	Monte Carlo Simulation (cont.)
2020.11.17.	Selection, acquisition, integrated validation and management of subsurface data for calculating	Monte Carlo Simulation (cont.)
2020.11.24.	PIIP. Assessment of uncertainties in delineation of pay rock volume. Mapping reservoir structure, gross and net thickness, and reservoir properties. Rules of determining and mapping reservoir thickness values	Coalbed Methane Fundamentals
2020.12.01.	Principles of mapping reservoir parameters. Steps of building a high resolution 3-D model. Feedback from dynamic model and field performance data to upgrade the static model	Geological Storage of CO ₂
2020.12.08.	Resource – reserves categorization (terms and definitions; classification/categorization systems, SEC	Reservoir Simulation

	and SPE-PRMS, UNFC as most frequently used systems; challenges and responses)	
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3. EXAM QUESTIONS

1. Reservoir Geology: from operative plans to strategic vision.
2. Duties of geoscientists and engineers.
3. Cores and core description. Lithology, facies and facies groups.
4. Determination of reservoir geometry – steps to determine reservoir bulk rock volume.
5. Structural cross sections: determination and visualisation of structural elements.
6. Determination of Pay Rock Volume (PRV)..
7. Definition of fluid contact types. Vertical delineation of PRV.
8. Reservoir geological (static) model and volumetric determination of Petroleum Initially - in – Place (PIIP)..
9. Principles of mapping reservoir parameters
10. Resource – reserves categorization (terms and definitions;classification/categorization systems,SEC and SPE-PRMS, UNFC as most frequently used systems.

4. OTHER REQUIREMENTS

A zárthelyi dolgozat írása és a vizsga közben a mobiltelefon használata tilos!

Miskolc, 2020. August 27.

Dr. Viktor Má dai
associate professor