



# **OILFIELD CHEMISTRY**

*MSc in Petroleum Engineering* **MFKOT720011**

**COURSE DESCRIPTION**

**FACULTY OF EARTH AND  
ENVIRONMENTAL SCIENCES AND ENGINEERING  
MINING AND ENERGY INSTITUTE**

**2024. Spring Term**



### **Course Data Sheet**

<b>Course Title:</b> Oilfield Chemistry <b>Instructor:</b> Dr. István LAKATOS, professor emeritus	<b>Code:</b> MFKOT720011 <b>Responsible department/institute:</b> DPE/IPNG (OMTSZ/KFGI) <b>Course Element:</b> Compulsory
<b>Position in curriculum*</b> (which semester): 1 (2)	<b>Pre-requisites (if any):</b> -
<b>No. of contact hours per week (lecture + seminar):</b> 2+1	<b>Type of Assessment (examination / practical mark / other):</b> examination
<b>Credits:</b> 3	<b>Course:</b> full time

**Course Description:**

1. Fundamentals of physical chemistry and colloid chemistry: behavior of real gases, equilibria, reaction kinetics, sorption phenomena.
2. Fundamentals of physical chemistry and colloid chemistry: rheology, diffusion, colloid systems, surface and interfacial tension.
3. Fundamentals of physical chemistry and colloid chemistry: capillary forces, wettability
4. Fundamentals of physical chemistry and colloid chemistry: properties of suspensions and emulsions.
5. Chemistry of drilling muds.
6. Chemistry of well completion fluids.
7. Chemical well stimulation methods including hydraulic fracturing, acidization, profile control in water injection wells.
8. Chemical methods providing selective fluid flow in oil and gas producing wells (water shutoff treatments and GOR improving techniques).
9. Fundamentals of intensive flooding technologies addressing the whole reservoir space.
10. Chemical aspects of improved and enhanced oil and gas productions methods (IOR/EOR and IGR/EGR), including the thermal, gas injection and chemical (alkaline, surfactant and polymer) technologies.
11. Mitigation of formation damage by chemicals, bottomhole clean-up for paraffin, asphaltene deposits, and chemical sand control in wells.
12. Basics of water technology: composition of formation waters, mechanism of scale formation, their inhibition and removal of inorganic scales by chemicals.
13. Surface and underground corrosion of metallic structures, types and origin of corrosion, corrosion inhibitors.
14. Hydrocarbon hydrates and inhibition of hydrate formation at well site and transport pipelines.

Competencies to evolve:

Knowledge:

Knows the economic processes related to the hydrocarbon industry.

Knows the equipment and methods required for the drilling and completion of oil, natural gas and water wells and has the necessary knowledge to plan drillings.

Knows the malfunctions that typically occur during the construction of oil, natural gas, and water wells and how to resolve them.

Knows the processes and phenomena occurring during production in petroleum and natural gas water wells.

Knows the equipment used for different types of production; and the methods ensuring the appropriate selection of the necessary equipment and procedures.

Knows the properties of the fluids found in petroleum, natural gas and geothermal reservoirs, as well as the storage rocks; characteristics of flow in such reservoirs.

Knows the production mechanisms of underground reservoirs and the primary or enhanced extraction mechanisms that ensure optimal production.

Knows the basics of numerical simulation of underground storages.

Knows the equipment and procedures related to the pipeline transportation of crude oil, natural gas and water.

Knows the basics of field and transmission line transport planning and operation.

Knows the methods and tools of computerized design and analysis in the hydrocarbon industry.

Ability:

Able to interpret the economic processes related to the hydrocarbon industry and to give adequate answers to them.

Able to manage groups operating the equipment required for the drilling and completion of oil, natural gas and water wells and to plan the drilling.

Able to avoid and eliminate malfunctions that typically occur during the construction of oil, natural gas, and water wells.

Capable of monitoring and forecasting the processes taking place in oil and natural gas water wells.

Able to choose the optimal production method, design and select the production equipment.

Capable of predicting the behavior of fluids in petroleum, natural gas, and geothermal reservoirs, the properties of reservoir rocks, and the characteristics of flow in such reservoirs.

Able to recognize the production mechanisms of underground reservoirs and select the primary or enhanced extraction mechanisms that provide optimal production.

Capable of numerical simulation of underground storages.

Capable of hydrocarbon industrial computer design and analysis.

Attitude:

Autonomy and responsibility:

Able to independently manage hydrocarbon industrial complex planning works and perform project management tasks, or participate in them.

Capable, as an efficient part of a group, of planning the drilling and completion of fluid producing wells and conducting deep drilling; to optimize the costs of deep drilling; to prevent malfunctions occurring during deep drilling.

Autonomously able to plan the production of fluid-producing wells, to achieve optimal production conditions; for the appropriate selection of the necessary equipment and procedures; to implement solutions that ensure maximum profit.

Capable of independently choosing the appropriate mechanisms for the production of underground reservoirs; to implement the most favorable "reservoir management".

Able to independently plan the transportation of fluids and operate the transportation equipment.

Able to autonomously plan the use of energy carriers produced from renewable natural resources and residual materials in the energy supply system, and manage the operation of the established system.

Takes responsibility for his/her professional decisions and the work processes carried out by him/her or under his/her control.

**Assessment and grading:**

Students will be assessed with using the following elements.

Attendance:	5 %
Midterm exam	40 %
Final exam	55 %
Total	100%

**Grading scale:**

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory )
60 - 69%	2 (pass)
0 - 59%	1 (failed)

**Compulsory or recommended literature resources:**

- Laider, K. J., Meiser, J. H.: "Physical Chemistry" Houghton Mifflin Co., ISBN 0-395-91848-0, Boston (USA), 1999
- Atkins, P. W.: "Physical Chemistry", Oxford Univ. Press, ISBN 0-19-850102-1, Oxford (UK), 1998
- Green, D. W., Willhite, G. P.: "Enhanced Oil Recovery", SPE Inc., ISBN 1-55563-077-4, Richardson (USA), 1998
- Schechter, R. S.: "Oil Well Stimulation", Prentice Hall International, ISBN 0-13-949934-2, Englewood Cliffs (USA), 1992
- Jones, L. W.: "Corrosion and Water Technology for Petroleum Producers", Oil and Gas Consultants International Inc., ISBN 0-930972-09-0, Tulsa (USA), 1990

### Course Schedule for 2023/24 school year

<b>Date</b>	<b>Topic</b>
2024.02.14	Fundamentals of physical chemistry and colloid chemistry: behavior of real gases, equilibria, reaction kinetics, sorption phenomena.
2024.02.21	Fundamentals of physical chemistry and colloid chemistry: rheology, diffusion, colloid systems, surface and interfacial tension.
2024.02.28	Fundamentals of physical chemistry and colloid chemistry: capillary forces, wettability
2024.03.06	Fundamentals of physical chemistry and colloid chemistry: properties of suspensions and emulsions.
2024.03.13	Chemistry of drilling muds.
2024.03.20	Chemistry of well completion fluids. Chemical well stimulation methods including hydraulic fracturing, acidization, profile control in water injection wells.
2024.03.27	Chemical methods providing selective fluid flow in oil and gas producing wells (water shutoff treatments and GOR improving techniques).
2024.04.10	Fundamentals of intensive flooding technologies addressing the whole reservoir space.
2024.04.17	Chemical aspects of improved and enhanced oil and gas productions methods (IOR/EOR and IGR/EGR), including the thermal, gas injection and chemical (alkaline, surfactant and polymer) technologies.
2024.04.24	Mitigation of formation damage by chemicals, bottomhole clean-up for paraffin, asphaltene deposits, and chemical sand control in wells.
2024.05.01	Basics of water technology: composition of formation waters, mechanism of scale formation, their inhibition and removal of inorganic scales by chemicals.
2024.05.08	Surface and underground corrosion of metallic structures, types and origin of corrosion, corrosion inhibitors. Hydrocarbon hydrates and inhibition of hydrate formation at well site and transport pipelines.
2024.05.15	Test writing.

## Examination review questions

- Fundamentals of physical chemistry and colloid chemistry: behavior of real gases, equilibria, reaction kinetics, sorption phenomena.
- Fundamentals of physical chemistry and colloid chemistry: rheology, diffusion, colloid systems, surface and interfacial tension.
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- Fundamentals of physical chemistry and colloid chemistry: properties of suspensions and emulsions.
- Chemistry of drilling muds.
- Chemistry of well completion fluids.
- Chemical well stimulation methods including hydraulic fracturing, acidization, profile control in water injection wells.
- Chemical methods providing selective fluid flow in oil and gas producing wells (water shutoff treatments and GOR improving techniques).
- Fundamentals of intensive flooding technologies addressing the whole reservoir space.
- Chemical aspects of improved and enhanced oil and gas productions methods (IOR/EOR and IGR/EGR), including the thermal, gas injection and chemical (alkaline, surfactant and polymer) technologies.
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- Hydrocarbon hydrates and inhibition of hydrate formation at well site and transport pipelines.



