UNIVERSITY OF MISKOLC

FACULTY OF
EARTH AND ENVIRONMENTAL
SCIENCES AND ENGINEERING

NODAL ANALYSIS APPLICATIONS

MSc in Petroleum Engineering **MFKOT730016**

COURSE DESCRIPTION

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

2024. Spring Term

Course Data Sheet

Course Title: NODAL Analysis Applications **Instructor:** Dr. Zoltán TURZÓ associate professor Abdulameer ALMALICHY PhD student	**Code:** MFKOT730016 **Responsible department/institute:** DPE/IPNG (OMTSZ/KFGI) **Course Element: Compulsory**
Position in curriculum* (which semester): 4 (3)	**Pre-requisites (if any):** Production Engineering Fundamentals MFKOT720025
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 2	**Course:** full time

Course Description:

1. General introduction of NODAL Analysis programs.
2. Building of the NODAL Analysis model.
3. Testing of the model using field data.
4. Using of the model for inspection, optimization.
5. Using of the model for design.
6. Connection to other simulators.
7. Nodal Analysis of flowing wells: oil wells
8. Nodal Analysis of flowing wells: gas wells
9. Nodal Analysis of flowing wells: multilateral wells
10. Nodal Analysis of gas lifted wells.
11. Nodal Analysis of sucker rod pumped wells.
12. Nodal Analysis of ESP wells.
13. Nodal Analysis of PCP wells.
14. Simulation and optimization of networks and gathering systems.

Competencies to evolve:

Knowledge:

Knows the economic processes related to the hydrocarbon industry.

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 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.

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.

Able to supervise and inspect equipment related to pipeline transportation of crude oil, natural gas and water.

Able to select equipment for field and transmission line transport and supervise the operation of the equipment and manage the participating groups.

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.

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.
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:

- Beggs, H. D.: Production Optimization Using NODAL Analysis, OGCI Publications, 2003. ISBN: 0-930972-14-7
- Takács, G.: Gas Lift Manual., PennWell Corporation, Tulsa, USA. 2005. 478p, ISBN 0-87814-805-1.
- Takács, G.: Sucker-rod pumping manual. Tulsa : PennWell, 2003. 395 p. ISBN 0 87814 899 2
- Takács, G.: Electrical submersible pumps manual. Elsevier, 2009. 425 p. ISBN 978 1 85617 557 9.
- Cholet, H.: Progressing cavity pumps. Editions Technip, Paris. 1997. 112p. ISBN 2-7108-0724-6.

Course Schedule for 2023/24 school year

Date	Topic
2024.02.15	General introduction of NODAL Analysis programs. Building of the NODAL Analysis model.
2024.02.22	Testing of the model using field data. Using of the model for inspection, optimization.
2024.02.29	Using of the model for design. Connection to other simulators. Nodal Analysis of flowing wells: oil wells
2024.03.07	Nodal Analysis of flowing wells: oil wells
2024.03.14	Nodal Analysis of flowing wells: gas wells
2024.03.21	Nodal Analysis of flowing wells: multilateral wells
2024.03.28	Nodal Analysis of gas lifted wells.
2024.04.11	Nodal Analysis of sucker rod pumped wells.
2024.04.18	Nodal Analysis of ESP wells.
2024.04.25	Test writing.

Examination review questions

1. NODAL analysis methodology for oil and gas wells
2. Elemet of NODAL analysis softwares.
3. Modelling of Naturaly flowing wells.
4. Modelling of Gas Wells.
5. Modelling of Continuous Flow Gas Lifted Wells
6. Modelling of Intermittent Flow Gas Lifted Wells
7. Modelling of Sucker Rod Pumped Wells
8. Modelling of ESP pumped Wells
9. Modelling of PCP Pumped Wells
10. Modelling of Multiulateral wells.
11. Modelling of a Gathering Network