UNIVERSITY OF MISKOLC
FACULTY OF **EARTH SCIENCE AND ENGINEERING**
1735

GEOTHEMAL WELL DRILLING

MSc in Petroleum Engineering **MFKOT730025**

COURSE DESCRIPTION

University of Miskolc
Faculty of Earth Science and Engineering
Petroleum and Natural Gas Institute
September 2022

Course Data Sheet

Course Title: Compulsory Electives II.: Geothermal Well Drilling **Instructor:** Dr. Imre FEDERER, honor associate professor	**Code:** MFKOT730025 **Responsible department/institute:** DPE/IPNG (OMTSZ/KFGI) **Course Element: Compulsory Elective**
Position in curriculum* (which semester): 1 (2)	**Pre-requisites (if any):** no
No. of contact hours per week (lecture + seminar): 2+0	**Type of Assessment (examination / practical mark / other):** examination
Credits: 2	**Course:** full time

Course Description:

1. The Geothermal drilling process.
2. The special drill string elements and drill string design, drill string loadings, drill bit selection for Geothermal Well Drilling.
3. Specialties in drilling mud engineering, and rig hydraulics.
4. Determination of fracturing gradient, casing shoe selection
5. Casing design, factors affecting casing.
6. Biaxial forces determination in casing design, bending forces.
7. Running casing operations.
8. Unscheduled event during drilling operation.
9. Wellbore stability, determination of rock properties, stress distribution around the wellbore.
10. Preventing borehole instability.
11. Primary cementing design, selection of cement and additives.
12. Cement slurry lab test, cementing calculations, effective mud removal.
13. Elements of well costing and affecting for well costing.
14. Drilling time estimate, drilling risk estimates, contracting strategies.

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 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 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. 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 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
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:

- H. Rabia: Oilwell Drilling Engineering. Principles and Practice. Graham Tratman Ltd. London 1995. 322 p.
- Howard B. Bradley: Petroleum Engineering Handbook, Third Printing, Society of Petroleum Engineers, Richardson, TX, U.S.A. 1992.
- Drilling Data Handbook, Edítion Technip, Paris ISBN 2-2108-0756-4, 1999. 542 p.
- Erik B. Nelson: Well Cementing. Schlumberger Educational Services. Second Edition, Houston Texas, 2006.
- R. DiPippo: Geothermal Power Plants, Butterworth-Heinemann 2012.

Course Schedule for 2022/23 school year

Date	Topic
09.15	The Geothermal drilling process.
09.22	The special drill string elements and drill string design, drill string loadings, drill bit selection for Geothermal Well Drilling.
09.29	Specialties in drilling mud engineering, and rig hydraulics.
10.06	Determination of fracturing gradient, casing shoe selection
10.13	Casing design, factors affecting casing. Biaxial forces determination in casing design, bending forces. Running casing operations.
10.20	Educational break
10.27	Educational break
11.03	Unscheduled event during drilling operation. Wellbore stability, determination of rock properties, stress distribution around the wellbore.
11.10	Preventing borehole instability.
11.17	Primary cementing design, selection of cement and additives.
11.24	Cement slurry lab test, cementing calculations, effective mud removal.
12.01	Elements of well costing and affecting for well costing. Drilling time estimate, drilling risk estimates, contracting strategies.
12.08	Test writing.

Test Example

16. Which one of the following gaskets matches the 6BX type flange.

A. Type R Octagonal.
B. Type RX.
C. Type BX.

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17. Which dimension is the nominal flange size?

A. Inside diameter
B. Outside diameter

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18. What is the main function of a diverter?

A. To create sufficient back-pressure to stop formation fluids entering the well bore.
B. To shut the well in.
C. To direct fluids to a safe distance from the rig floor.

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19. Which one of the following is 'good practice' in relation to diverter systems?

A. Open the diverter vent line before closing the diverter.
B. The diverter system doesn't need to be included in the rig maintenance programme.
C. For safety, the diverter should only be operated some distance away from the rig floor.

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20. There is only one inside BOP with an NC38 (3-1/2 inch IF) pin/box connection on the rig.
The drill string consists of:

- 3-1/2 inch drill pipe (NC38).
- 2-7/8 inch drill pipe (NC31).

Which of the following crossovers must be on the rig floor while tripping?

A. NC46 (4 inch IF) box x NC38 (3-1/2 inch IF) pin.
B. NC38 (3-1/2 inch IF) box x NC31 (2-7/8 inch IF) pin.
C. NC40 (4 inch IF) box x NC26 (2-3/8 inch IF) pin.

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21. Before cutting the drilling line, with the bit at the casing shoe, which item of equipment must
be installed to make the operation safe?

A. Full opening safety valve.
B. Full opening safety valve and an inside blowout preventer.
C. Inside blowout preventer.

Examination review questions

1. The geothermal drilling process, the special drill string elements and drill string design, drill string loadings,

2. Drill bit selection for geothermal well drilling,

3. Specialties in drilling mud engineering, and rig hydraulics,

4. Determination of fracturing gradient,

5. Casing shoe selection, casing design, factors affecting casing, biaxial forces determination in casing design, bending forces, running casing operations,

6. Unscheduled event during drilling operation,

7. Wellbore stability, determination of rock properties,

8. Stress distribution around the wellbore, preventing borehole instability,

9. Primary cementing design, selection of cement and additives, cement slurry lab test,

10. Cementing calculations, effective mud removal,

11. Elements of well costing and affecting for well costing,

12. Drilling time estimate, drilling risk estimates, contracting strategies.