UNIVERSITY OF MISKOLC

FACULTY OF
EARTH AND ENVIRONMENTAL
SCIENCES AND ENGINEERING

DRILLING ENGINEERING I.

MSc in Petroleum Engineering **MFKOT720022**

COURSE DESCRIPTION

University of Miskolc
Faculty of Earth Science and Engineering
Petroleum and Natural Gas Institute
2024

Course Data Sheet

<table>
<tr><td>Course Title: Drilling Engineering I.
Instructor: Dr. Gabriella FEDERER-KOVACS associate professor</td><td>Code: MFKOT720022
Responsible department/institute: DPE/MEI (OMTSZ/BEI)
Course Element: Compulsory</td></tr>
<tr><td>Position in curriculum*
(which semester): 2
(1)</td><td>Pre-requisites (if any): -</td></tr>
<tr><td>No. of contact hours per week (lecture + seminar): 2+2</td><td>Type of Assessment (examination / practical mark / other): examination</td></tr>
<tr><td>Credits: 6</td><td>Course: full time</td></tr>
<tr><td colspan="2">Course Description:
1. The drilling process, unit systems pressure conditions in the borehole.
2. Metric unit system, field units. Conversion.
3. The drilling rig.
4. The drill string: components, design.
5. Hoisting, drawworks
6. Drill bits: design and classification of roller and diamond bits.
7. Dull bit evaluation.
8. Test 1
9. Fundamentals of fluid flow
10. Mud engineering
11. Laboratory practice 1
12. Laboratory practice 2
13. Rig hydraulics
14. Test 2
Competencies to evolve:
Knowledge: T1, T2, T3, T11
Ability: K1, K2, K3, K11
Attitude:
Autonomy and responsibility: F1, F2, F6, F7</td></tr>
<tr><td>Assessment and grading:
Signature requirements: The written tests will cover the course material reviewed till the test’s date. The total signature grade should be above 60% and min. 60 % is required in both tests to earn the signature. There is no possibility to improve the written tests. The signature grading is the following:</td><td>Grades: The grading depends on the oral exam’s result however some extra bonuses can be earned in the semester. The bonus system is the following:
<table><tr><td>Signature grade</td><td>Bonus</td></tr></table></td></tr>
</table>

Attendance:	5 %	91% or above	offered a 5, excellent grade
Homework	10 %	76% to 90%	+ 1 grade at the oral exam
Midterm exam	40 %	75% or below	no effect on the oral exam's result
Final exam	45 %		
Total	100%		

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, Edition Technip, Paris ISBN 2-2108-0756-4, 1999. 542 p.
- Erik B. Nelson: Well Cementing. Schlumberger Educational Services. Second Edition, Houston Texas, 2006
- H. Dale Beggs: Gas production operation. OGCI Publications, Tulsa, 1984.
- Arthur Lubinski (Edited by Stefan Miska): Development of Petroleum Engineering I-II. Gulf Publishing Company, Houston, 1987.

Course Schedule based on 2023/24 school year

Date	Topic
12.febr	The drilling process, unit systems pressure conditions in the borehole.
19.febr	Metric unit system, field units. Conversion.
26.febr	The drilling rig.
04.márc	The drill string: components, design.
11.márc	Hoisting, drawworks
18.márc	Drill bits: design and classification of roller and diamond bits.
25.márc	Dull bit evaluation.
01.ápr	Test 1-online due to holiday
08.ápr	Fundamentals of fluid flow
15.ápr	Mud engineering
22.ápr	Laboratory practice 1
29.ápr	Laboratory practice 2
06.máj	Rig hydraulics
13.máj	Test writing.

Test Example

4) There are two different kind of connection on a drill pipe. Which connection faces upward? _____/1 pont

☐ Box connection ☐ Pin connection

5) What is the spiral drill collar good for? _____/1 pont

☐ It makes the drill string thinner ☐ It helps drilling ☐ It can help to prevent stuck pipe ☐ None

6) The teeth of the tugsten carbide bit are harder than the cutting structure of a diamond bit. _____/1 pont

☐ True ☐ False

7) It is generally true about the rigs that _____/1 pont

☐ they can be moved ☐ they all drill with a kelly ☐ they can all be used on land ☐ they all use top drive

8) In case if there is a stuck pipe which of the following equipment is used to free the pipe? _____/1 pont

☐ Crossover ☐ Jar ☐ Reamer ☐ Stabilizator

9) Fill in the empty space with the correct phrase: _____/1 pont

The drilling is called.....if the downhole pressure is less than the formation pressure.

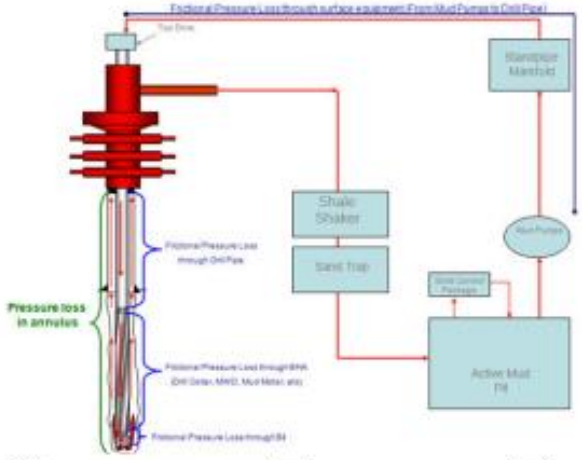
☐ Underbalanced ☐ Balanced ☐ Overbalanced

10) Which one is not part of the drillstring? _____/2 pont

☐ Kelly ☐ Rotary hose ☐ Drill collar ☐ Bit ☐ Heavy wall drill pipe ☐ MWD/LWD

☐ Crossover

11) Which pressure loss effects the bottomhole? _____/2 pont



☐ Drill string pressure loss ☐ Annular pressure loss ☐ Pump pressure loss ☐ Pressure loss through nozzle

12) The pressure loss of the circulating system equals to.. _____/2 pont

☐ the pressure limit of the separator. ☐ the annular pressure ☐ the pump pressure.

☐ the formation pressure.

16) Based on the attached table what can be the IADC code of the following bit description: _____/3 pont

- It has the hardest milled tooth

- Cutting structure is for the hardest formation within the series

- It has roller bearing and gage-protected

- It has extended jets

First digit: Cutting Structure Series (1 – 8)

Eight categories or "Series" numbers describe general formation characteristics.

Series 1, 2 and 3 refer to steel tooth (milled tooth) bits.

Series 4, 5, 6, 7 and 8 refer to insert (tungsten carbide) bits.

Within the steel tooth and insert groups, the formation becomes harder and more abrasive as the Series numbers increase.

Second digit: Cutting Structure Types (1 – 4)

Each Series is divided into 4 "Types" or degrees of hardness. Type 1 refers to bits designed for the softest formation in a particular Series. Type 4 refers to the hardest formation within the Series.

Third digit: Bearing/Gage (1 – 7)

Seven categories of bearing design and gage protection are defined as "Bearing/Gage":

1 = standard roller bearing
2 = roller bearing, air-cooled
3 = roller bearing, gage-protected
4 = sealed roller bearing
5 = sealed roller bearing, gage-protected
6 = sealed friction bearing
7 = sealed friction bearing, gage-protected

Categories 8 and 9 are reserved for future use.

Additional letter

A = air application
B = special bearing seal
C = center jet
D = deviation control
E = extended jets
G = gauge/body protection
H = horizontal/steering application
J = jet deflection
L = lug pads
M = motor application
S = standard steel tooth model
T = two cone bits
W = enhanced cutting structure
X = predominantly chisel tooth insert
Y = conical tooth insert
Z = other shape insert

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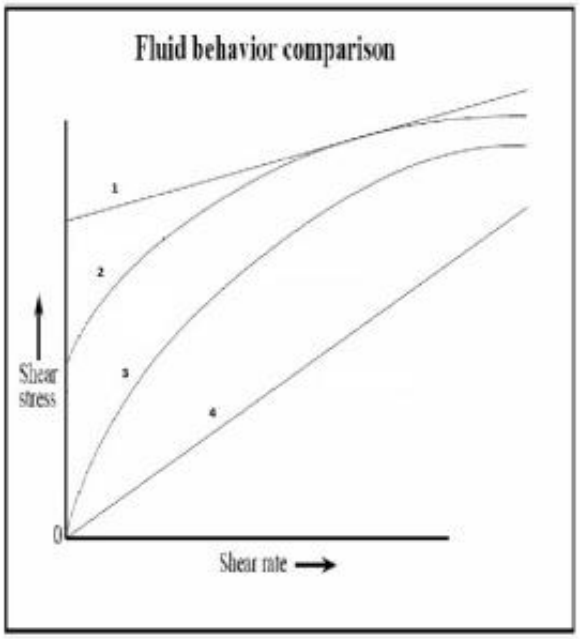
17) Based on the attached image pair the fluid behaviour with the numbers. _____/8 pont



☐ Newtonean liquid ☐ Bingham plastic ☐ Power law ☐ Typical drilling mud

[1] 1 [2] 2 [3] 3 [4] 4

Examination review questions

1. The drilling rig components,
2. Hoisting: hoisting elements and their functions,
3. The drilling process, unit systems,
4. The drill string design: drill string elements and their functions,
5. Typical BHA configurations,
6. Drill string design calculation.
7. Drill bits: design and classification of roller and diamond bits,
8. Dull bit evaluation,
9. Drill bit selection (drilling cost calculation).
10. Fundamentals of fluid flow and mud characteristics
11. Rig hydraulics