ARTIFICIAL LIFTING I.

MSc in Petroleum Engineering **MFKOT720017**

COURSE DESCRIPTION

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

2026. Fall Term

Course Data Sheet

Course Title: Artificial Lifting I **Instructor:** Dr. Gábor TAKÁCS professor emeritus	**Code:** MFKOT720017 **Responsible department/institute:** DPE/IPNG (OMTSZ/KFGI) **Course Element: Compulsory**
Position in curriculum* (which semester): 3 (2)	**Pre-requisites (if any):** Production engineering fundamentals (MFKOT720025)
No. of contact hours per week (lecture + seminar): 2+2	**Type of Assessment (examination / practical mark / other):** examination
Credits: 6	**Course:** full time

Course Description:

1. Introduction to artificial lifting: history, main features, comparison.
2. Components of the sucker-rod pumping system: downhole pumps, sucker-rod string.
3. Mechanical design of the sucker-rod string, failure modes.
4. Surface equipment, pumping units, unit geometries.
5. Kinematics of pumping units. Gearboxes, prime movers.
6. Calculation of operational parameters of rod pumping: approximate models.
7. Dynamics of rod strings.
8. The API RP 11L model: calculation accuracy, application ranges.
9. Simulation of the sucker-rod string's behavior.
10. Forms of the one-dimensional wave equation, solution methods, calculation of downhole cards.
11. Torsional analysis of pumping units, optimum counterbalancing.
12. Design of the pumping system, selection of the optimum pumping mode.
13. Intermittent pumping.
14. Analysis of the pumping system's operation: well testing, the use of dynamometers, evaluation of dynamometer cards.

Competencies to evolve:
Knowledge: T1, T4, T5, T11
Ability: K1, K4, K5, K9, K10, K11
Attitude:
Autonomy and responsibility: F1, F3, F6, F7

Assessment and grading:

Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Midterm exam	40 %
Final exam	45 %
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:

- Takács G.: Basic sucker rod pumping. Miskolc, ME, 1992. 321 p.
- Takács G.: Sucker-rod pumping manual. Tulsa : PennWell, 2003. 395 p. ISBN 0 87814 899 2
- G. Takács: Modern sucker-rod pumping. Tulsa : PennWell, 1993. 230 p. ISBN 0 87814 383 1
- Production Operations Engineering, Petroleum Engineering Handbook Vol 4, SPE, 2006
- George V.Chilingarian et.al.: Surface Operations in Petroleum Production II, Elsevier, 1989.

Szilas, A.P.: Production and Transport of Oil and Gas. Part B., Akadémiai Kiadó, Budapest, 1986., ISBN 963-05-3363-4

Course Schedule for 2026/27 school year, fall term

Date	Topic
2026.09.10	Introduction to artificial lifting: history, main features, comparison.
2026.09.17	Components of the sucker-rod pumping system: downhole pumps, sucker-rod string.
2026.09.24	Mechanical design of the sucker-rod string, failure modes. Surface equipment, pumping units, unit geometries.
2026.10.01	Kinematics of pumping units. Gearboxes, prime movers.
2026.10.08	Calculation of operational parameters of rod pumping: approximate models. Dynamics of rod strings.
2026.10.15	The API RP 11L model: calculation accuracy, application ranges.
2026.10.22	Simulation of the sucker-rod string's behavior.
2026.11.05	Forms of the one-dimensional wave equation, solution methods, calculation of downhole cards.
2026.11.12	Torsional analysis of pumping units, optimum counterbalancing.
2026.11.19	Design of the pumping system, selection of the optimum pumping mode.
2026.11.26	Intermittent pumping.
2026.12.03	Analysis of the pumping system's operation: well testing, the use of dynamometers, evaluation of dynamometer cards.
2026.12.10	Test writing.

Test Example

CLOSED BOOK

NAME of STUDENT: _____ ID No.:_____

Problem Statement :

Calculate and plot the true and effective static loads for the down-, and upstroke in the rod string for the well given.

Pump Setting Depth=8,000 ft Dynamic Level=8,000 ft Wellhead Pressure=100 psi

Liquid Sp.Gr.=1.0 Plunger Size=1 1/4"

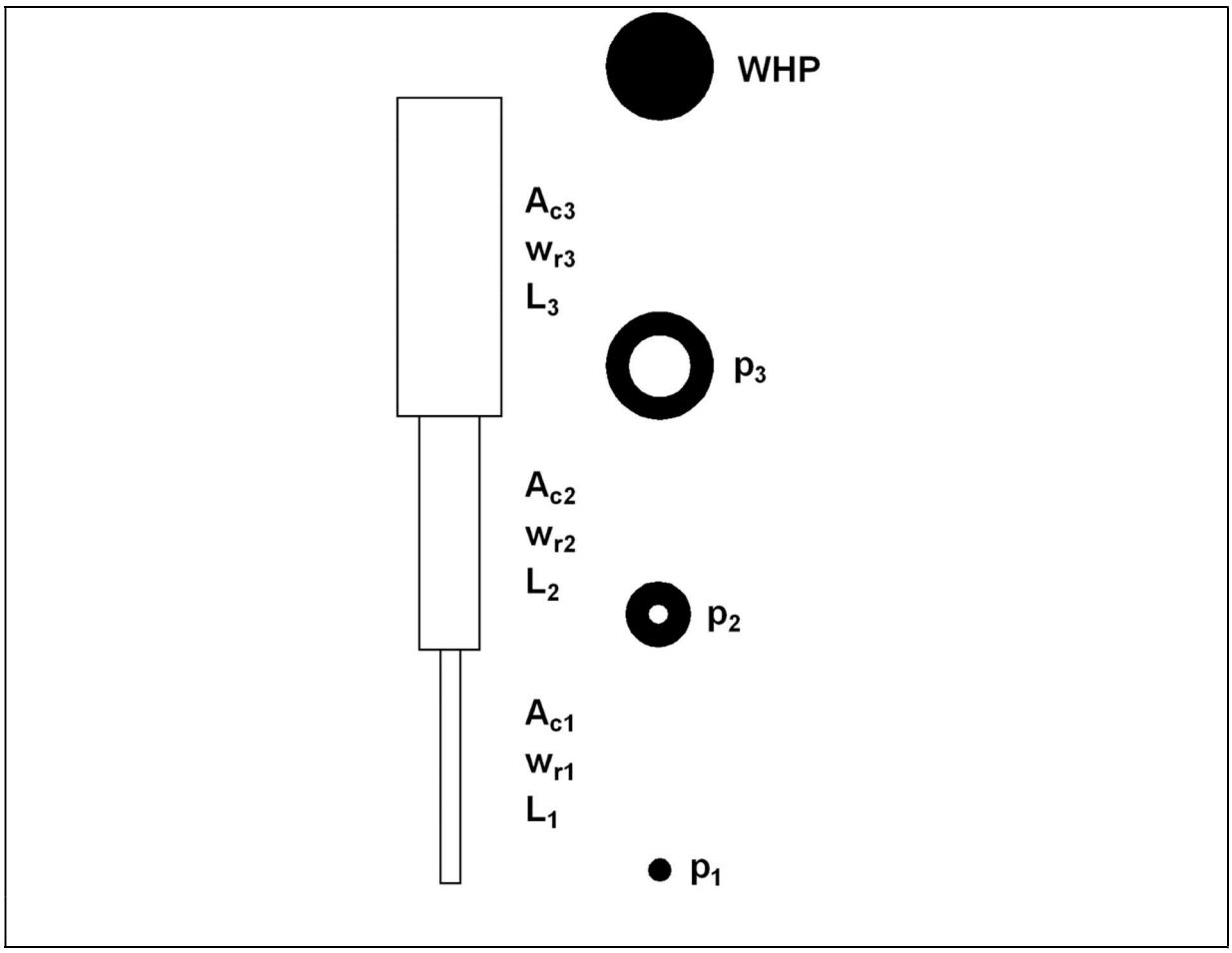
Steel Rod String: 2,223 ft of 7/8',
2,571 ft of 3/4", and
3,206 ft of 5/8" rods.

Instructions :

First calculate the downstroke static loads with the help of the sketch provided.

Effective Load = True Load + p A_{cr}

Solution :



p_1 = _____

p_2 = _____

p_3 = _____

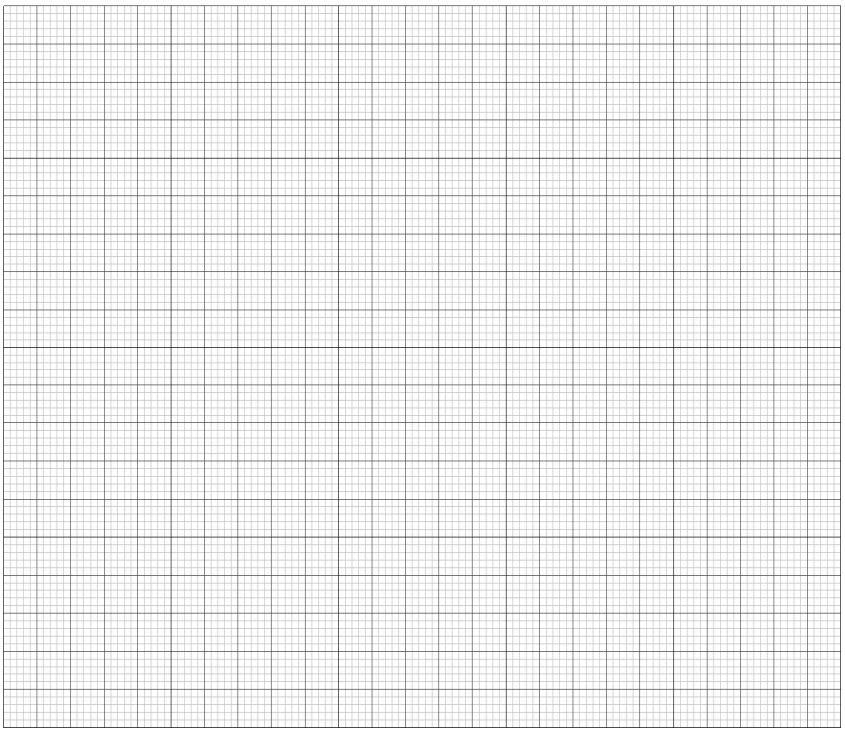
Fluid Load = _____

“I pledge that I have neither given nor received any unauthorized assistance on this exam.”

Student’s Signature: _____

	DOWNSTROKE		UPSTROKE	
	TRUE	**EFFECTIVE**	**TRUE**	**EFFECTIVE**
Taper #1 bottom				
Taper #1 top				
Taper #2 bottom				
Taper #2 top				
Taper #3 bottom				
Taper #3 top				

Plot your results on the chart provided.



Examination review questions

Artificial Lifting Types, Features
API Subsurface pumps and their features.
Non-API Subsurface pumps and their features.
Downhole gas separation, gas separator types
Sucker rod types, materials
The design of sucker rod strings.
Pumping units, their construction and kinematic parameters
The API RP 11L method
Simulation of the sucker-rod string's behavior
Torsional loading on speed reducers
Power requirements of rod pumping
The design of the pumping system, intermittent pumping
Analysis of rod pumping installations
The Basics of Dynamometry