Reservoir and Production Engineering

MSc in Petroleum Geoscience and Engineering **MFKOT730023**

COURSE DESCRIPTION

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

2026. Fall Term

Course Data Sheet

Course Title: Reservoir and production engineering

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week:**lec. 3, sem. 1**

Neptun code: MFKOT730023

Assessment and grading:
Students will be assessed with using the following elements:

Attendance:	10 %
First Test	25 %
Second Test	25 %
Final Exam	40 %
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)

Position in Curriculum (which semester): **third**

Pre-requisites *(if any)*: Core analysis.

Course Description:

Acquired store of learning:

Study goals: To give a sort overview basic definition, tools, evaluation and calculation methods that widely use in reservoir and production engineering practice. Preparing the reservoir geologist to work in a team with the reservoir and production engineers, during the characterization of hydrocarbon resources. Give a general overview how to design, forecast, and operate the production of hydrocarbon fields.

Course content:

1. Fundamental properties of porous media: Porosity, Compressibility, Specific surface area.
2. Fundamental properties of porous media: Saturation. Wettability and determination of capillary pressure.
3. Fundamental properties of porous media: permeability relative permeability.
4. PVT correlation for natural gases, for saturated and under saturated black oils.
5. PVT correlation for water. Equilibrium calculation of two phase hydrocarbon systems.
6. Viscosity correlations for petroleum reservoir fluids.
7. Inflow performance of oil wells. Basics of single-phase flow: description and pressure drop prediction.
8. Multiphase flow: basic concepts, flow patterns, empirical correlations, mechanistic models, gradient curves.
9. Temperature conditions in hydrocarbon producing wells.
10. Naturally flowing wells.
11. Separators, tanks and pipes.
12. Gas Lifting.
13. Sucker rod pumping.
14. NODAL Analysis.

Education method:Lecture: Power point presentations, animations, handouts. Lab exercises: demonstration measurements, discussions; hands-on calculation exercises, computer modeling (group assignments)

Competencies to evolve:

T1, T2, T5, T6, T7, T9, T12, K3, K4, K6, K8, K9, K10, A2, A5, F1, F2, F4, F5

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Towler: Fundamental Principles of Reservoir Engineering, SPE Textbook Series, Vol. 8., 2002, ISBN 1-55563-092-8.
- János Török, Lipót Fürcht, Tibor Bódi: PVT Properties of Reservoir Fluids. (Könyv). University of Miskolc Miskolc, Hungary 2012. ISBN 978-963-661-988-5 p. 1-192.
- J. Pápay: Development of Petroleum Reservoirs, Akadémiai K., Budapest 2003.
- A.P. Szilas: Production and Transport of Oil and Gas. Part A, B., Akadémiai Kiadó, Budapest, 1986.
- Takács G.: Fundamentals of Production Engineering. okt. segédlet, Miskolci Egyetem, 2005, 161p.
- G. Takács: Gas Lift Manual., PennWell Corporation, Tulsa, USA. 2005. 478p, ISBN 0-87814-805-1.

Responsible Instructor(*name, position, scientific degree):*

Zoltán Turzó Dr., associate professor, PhD

Course Schedule for 2026/27 school year

Date	Topic
2026.09.10	Fundamental properties of porous media: Porosity, Compressibility, Specific surface area.
2026.09.17	Fundamental properties of porous media: Saturation. Wettability and determination of capillary pressure.
2026.09.24	Fundamental properties of porous media: permeability relative permeability.
2026.10.01	PVT correlation for natural gases, for saturated and under saturated black oils.
2026.10.08	PVT correlation for water. Equilibrium calculation of two phase hydrocarbon systems. Viscosity correlations for petroleum reservoir fluids.
2026.10.15	Test Writing
2026.10.22	Multiphase flow: basic concepts, flow patterns, empirical correlations, mechanistic models, gradient curves.
2026.11.05	Inflow performance of oil wells. Basics of single-phase flow: description and pressure drop prediction.
2026.11.12	Temperature conditions in hydrocarbon producing wells.
2026.11.19	Naturally flowing wells. Separators, tanks and pipes.
2026.11.26	Gas Lifting.
2026.12.03	Sucker rod pumping. NODAL Analysis.
2026.12.10	Test writing

Test Example

CLOSED BOOK

NAME of STUDENT: _____ ID No.:_____

1. The volumetric liquid flow rate at the well bottom is always _____ than the rate measured at the stock tank.

   The relation between stock tank volume and actual volume is (give the formula and the definition of the terms):

   _____

2. How can you calculate the free gas volume (at standard conditions) if the well's oil rate (in STB), GOR and the solution GOR (R_s) at the given conditions are known:

   _____

3. The value of the volume factor for oil is always _____ .

4. Give the definition of the deviation factor for real gases in the relevant formula.

   Z =

5. List at least 3 assumptions that must be met for the validity of the productivity index formula.
   i. _____
   ii. _____
   iii. _____

6. How does the flow velocity change with pipe length in a horizontal pipe if only liquid is flowing?

   _____

7. List the possible flow patterns in an oil well, starting from the bottom.
   i. _____
   ii. _____
   iii. _____
   iv. _____

8. Give the definition of the superficial velocity in general if flow rate at standard conditions, q_{sc} is known; write down the formula.

   _____

9. Give the formula for calculating the mixture density in multiphase flow. Define the parameters!

_____	_____
_____	_____
_____	_____

10. List the main components of the multiphase vertical pressure drop along with their contribution to the total pressure drop, in case of an onshore oil well.

Component	Contribution, %
_____	___
_____	___
_____	___

11. What are the two main problems when calculating the pressure drop in an inclined oil well.

i. _____
ii. _____

12. In the vertical mist flow pattern where and in what form does the liquid flow.

i. _____
ii. _____

Problem Statement :

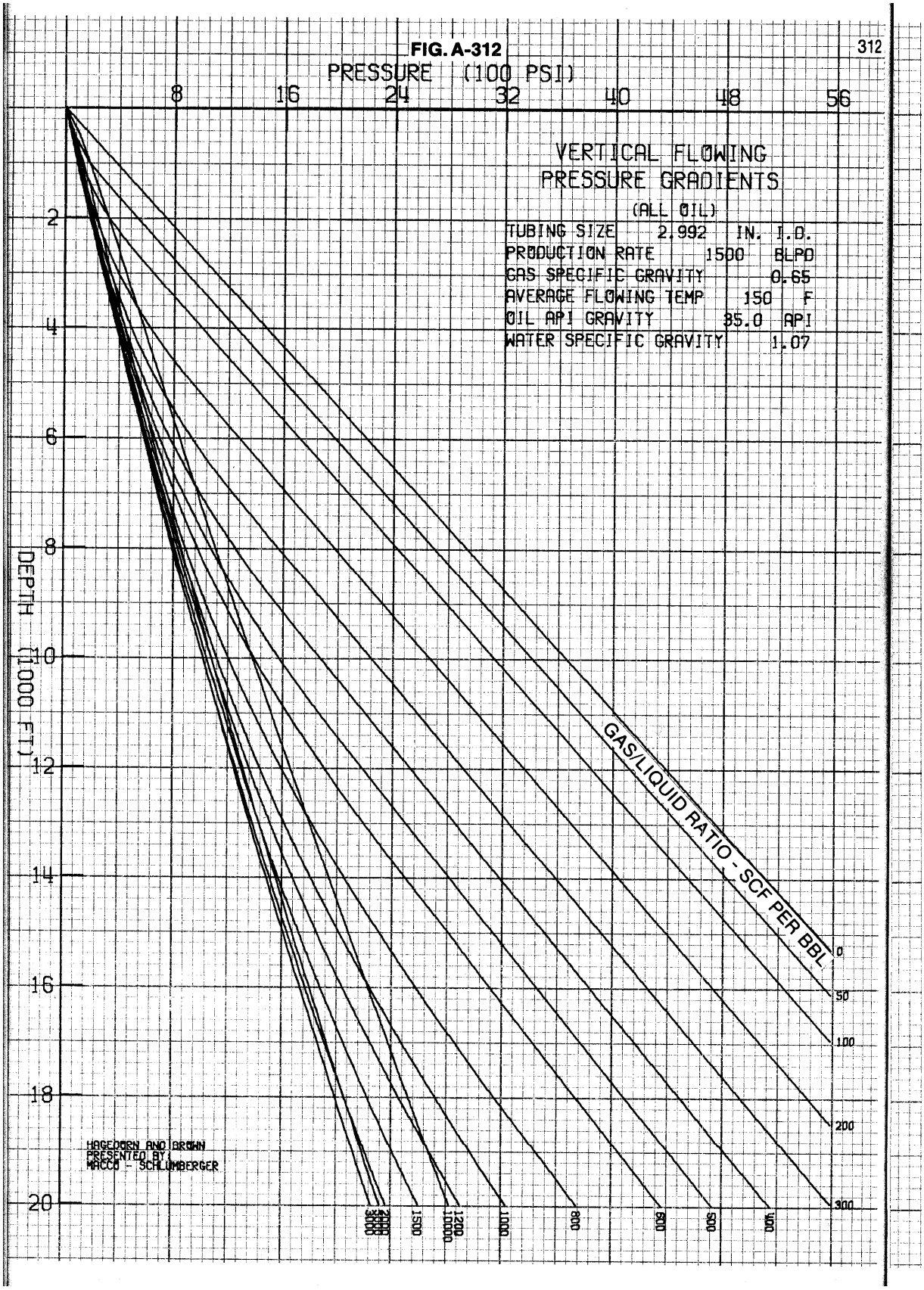
Part A: Find the flowing bottomhole pressure in a flowing well using the pressure gradient curve sheet supplied. Well data are the following:

Depth = 12,000 ft
Oil rate = 1,500 bpd
Tubing size = 3 in (2.992 in ID)
GLR = 800 scf/bbl
Wellhead pressure = 400 psi

Part B: Using the same data as in ***Part A***, find the wellhead pressure if the flowing bottomhole pressure equals 3,280 psi.

Instructions :

You can plot your graphical solution to the above problems directly on the gradient curve sheet.



„I pledge that I have neither given nor received any unauthorized assistance on this exam."

Student's Signature: _____

Examination review questions

Fundamental properties of porous media: Porosity, Compressibility, Specific surface area.
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Separators, tanks and pipes.
Gas Lifting.
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