EPS-441 – Petroleum Production and Development

Course Logistics

Class Information:

Section: GX
Time: S, M 9:00-9:50
Location: B 55 Lab 113
Web page: www.kau.edu.sa/hnaji

Instructor:

Name: Hassan S. Naji
Office: B55 Room 202 & 239
Office Hours
Mobile: 050-667-8889
Fax: 966 2 695-2095
Email: hassan@petrobjects.com (please use this for communication with me)

Required Text:

Craft, B.C., M. Hawkins, Revised by Ronald E. Terry: "Applied Petroleum Reservoir Engineering," Second Edition, Prentice Hall, 1991.

Supplemental Texts:

1) Petroleum Development Geology, Third Edition, Parke A. Dickey, PennWell.
2) Craft, B.C., M. Hawkins, Revised by Ronald E. Terry: "Applied Petroleum Reservoir Engineering," Second Edition, Prentice Hall, 1991.
3) Ahmed, T., "Reservoir Engineering Handbook," Second Edition, GPP.

Course Description

Systems of units and basic calculations required for the petroleum geologists. Introduction to some computer software relevant to petroleum development calculations. Subsurface pressure and abnormally high pressures. Rock properties, lithology, porosity, permeability, and compressibility. Fluid properties and phase behavior, oil and gas, oil field waters. Mutual properties of rocks and fluid, relative permeability and capillary pressure. Estimation of oil and gas reserves: volumetric methods, material balance methods. Material balance calculations and drive mechanism of oil and gas reservoirs. Water-flooding and enhanced oil recovery methods. Term project.

Course Objectives

The recognition of the importance of integrated disciplines amongst geologists, geophysicist, and engineers suggests that most of the petroleum geologists will be working in oil and gas field development rather than exploration. This course intends towards preparing students for this goal. Give them sound basis on the knowledge and geological parameters required for the success of numerical reservoir simulation.

Sample Exams

EPS-441: Petroleum Development and Production

1. The average reservoir properties of a 300 acre reservoir are:

N = 18%
Sw = 36%

Estimated volume of oil originally in place = 410 MMSTB. Formation thickness = 2000 ft. Determine the oil formation volume factor.

2. Given:

B_{ti} = 1.35469 bbl/STB
B_t = 1.37500 bbl/STB at 3600 psig
S_{wc} = 0.2
C_w = 3.6 x 10^{-6} psi^{-1}
B_w = 1.04 bbl/STB at 3600 psig
C_f = 5.0 x 10^{-6} psi^{-1}
p_i = 5000 psig
N_p = 1.25 MMSTB
)p = 1400 psi
W_p = 32,000 STB
W_e = 0.0

Calculate the amount of oil in place (OIP) with and without compressibilities.

3. The following data were given for a gas reservoir:

Initial pressure = 3250 psia
Reservoir temperature = 213 EF

Standard pressure = 15.025 psia
Standard temperature = 60 EF
Cumulative production = 1 x 10^9 SCF
Average reservoir pressure = 2864 psia
Gas deviation factor at 3250 psia = 0.910
Gas deviation factor at 2864 psia = 0.888
Gas deviation factor at 500 psia = 0.951

Calculate the initial gas in place for a closed gas reservoir with negligible water and rock compressibilities and no water influx.

4. A core has a length of 1.5 inches and a diameter of 0.75 inches was 100% saturated with water and placed in a liquid permeameter. The water has a viscosity of 1.0 cp. The linear flow rate was measured at 5.0 cc in 90 sec. with a pressure drop of 0.5 atm. Calculate the absolute permeability.

EPS-441: Petroleum Development and Production

Problem #1: A radial flow system has the following properties:

Drainage area	= 80 acres
Wellbore diameter	= 5 inches
Average formation thickness	= 25 ft
Pressure at reservoir boundary	= 2500 psig
Pressure at wellbore	= 1000 psig
Oil flow rate	= 300 STBOPD
Oil viscosity	= 1.35 cp,
B_o	= 1.35 RB/STB.

A. Calculate the average reservoir permeability.

B. What will the flow rate increase to if the pressure at the wellbore is reduced to 500 psig?.

C. What diameter must the wellbore be increased to if the wellbore pressure is maintained at 1000 psig but a flow rate equal to the flow rate in b above is desired?.

D. What must the viscosity be reduced to if the wellbore pressure is maintained at 1000 psig but a flow rate equal to the flow rate in b above is desired?.

E. What must the external pressure be increased to if the wellbore pressure is maintained at 1000 psig but a flow rate equal to the flow rate in b above is desired.

F. What must the permeability be increased to if the wellbore pressure is maintained at 1000 psig but a flow rate equal to the flow rate in b above is desired.

Problem #2:

Field data - 1 well

acre spacing	= 160 acres
formation thickness	= 25 ft
oil viscosity	= 2.3 cp
well diameter	= 8 inches
pressure at external radius	= 3600 psi
wellbore pressure	= 2200 psi

Laboratory test data on a core from above reservoir

linear-horizontal flow test	
pressure difference across sample	= 30 psi
cross-sectional flow area	= 3 in^2
core length	= 6 in
oil viscosity	= 0.8 cp
oil flow rate	= 1.0 BOPD

Using results from laboratory data, calculate production rate in the field.

Problem #3: The following data were given for a gas reservoir:

Initial pressure	= 3250 psia
Reservoir temperature	= 213 EF
Standard pressure	= 15.025 psia
Standard temperature	= 60 EF
Cumulative production	= 1 x 10^9 SCF
Average reservoir pressure	= 2864 psia
Gas deviation factor at 3250 psia	= 0.910
Gas deviation factor at 2864 psia	= 0.888
Gas deviation factor at 500 psia	= 0.951

A. Write the *general material balance equation*.

B. Calculate the initial gas in place for a closed gas reservoir with negligible water and rock compressibilities and no water influx.

C. If abandonment pressure is 500 psia, calculate the initial gas reserve.
D. Based on a 500 psia abandonment pressure, calculate the remaining gas.

Sample Home Works