UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, DEC 2014

COURSE NO: **PE 377**
COURSE NAME: **RESERVOIR ENGINEERING**
CLASS: **PE III** TIME: **3 HOURS**

Name: ______________________________ Index Number: ______________

ANSWER ALL QUESTIONS

QUESTION 1

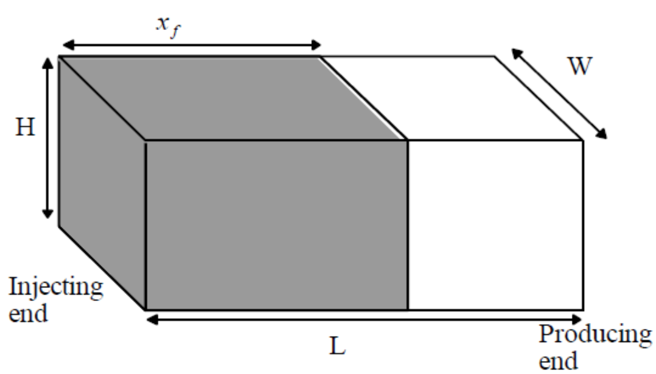
a) Show that $\rho = \rho_{ref}\,[1 - c\,(p_{ref} - p)]$ **(5 Marks)**

b) Write on the effects of the following factors on waterflooding process: **(9 Marks)**

i) Reservoir geometry ii) Fluid Properties iii) Fluid Saturation

c) There are many procedures for determining the optimum time to waterflood. How do you know which one to select? **(2 Marks)**

d) Below shows an oil reservoir which has undergone waterflooding. Core analysis tests indicate that the initial and residual oil saturations are 70 and 35%, respectively. Given that L = 2000 ft, H = W = 300 ft and x_f = 1100 ft, Calculate the recovery factor. **(4 Marks)**



QUESTION 2

a) UMaT reservoir has a radius of 6000 ft and an aquifer radius of 20,000ft. The following parameters are also available:

p_i = 3500 psi	p = 3000 psi	Q_o = 32,000 STB/day
B_o = 1.4 bbl/STB	GOR = 900 scf/STB	μ_w = 0.5cp
z = 0.82	Q_w = 0	B_w = 1.0 bbl/STB
k = 50 md	R_s = 700 scf/STB	T = 140°F

Calculate Schilthuis' water influx constant and height of the reservoir. **(8 Marks)**

b) The pressure history of a water-drive oil reservoir is given below:

t, days	p, psi
0	3450
50	3410
100	3370
150	3310
200	3200

The aquifer is under a steady-state flowing condition with an estimated water influx constant of 110 bbl/day/psi. Calculate the cumulative water influx after 50, 100, 150, and 200 days using the steady-state model. **(12 Marks)**

QUESTION 3

A gas with an apparent molecular weight of 32.05 is flowing in a linear reservoir system at 150 °F. The pressures at the entering and exiting ends are 2000 and 1800 psi, respectively. The following properties of the system are given:

L = 2000 ft W = 300 ft h = 15 ft k = 40 md ϕ = 15%

Calculate
a) the gas viscosity
b) the actual gas velocity **(15 Marks)**

QUESTION 4

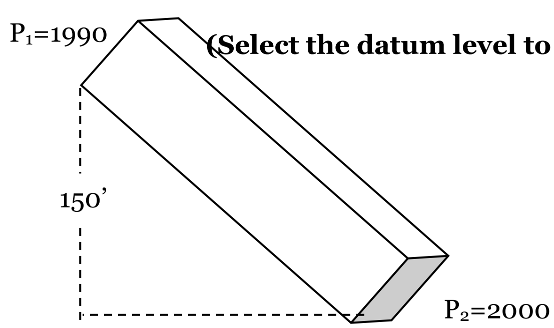
1) An incompressible fluid flowing in a linear porous media tilted at an angle of 15° as shown below has the following properties:

L = 2000 ft h = 25' w = 200' k = 90 md ϕ = 15 % μ = 2 cp

If the incompressible fluid has a density of 45 lb/ft^3, find:

(i) The direction of flow of the fluid
(ii) Flow rate in bbl/day
(iii) Actual fluid velocity in ft/day

(Select the datum level to be one third of the vertical distance from P_2)



(15 Marks)

EQUATIONS

$$Q_g = \frac{kh(\psi_e - \psi_w)}{1422T\left(In\frac{r_e}{r_w}\right)}$$

$$Q = \frac{0.00708kh(p_e - p_{wf})}{\mu BIn\left(r_e/r_w\right)}$$

$$Q_{sc} = \frac{0.111924Ak\left(p_1^2 - p_2^2\right)}{TLz\mu_g}$$

$$T_{pc} = 168 + 325\gamma_g - 12.5\gamma_g^2$$

$$e_w = \frac{dW_e}{dt} = B_o\frac{dN_p}{dt} + (GOR - R_s)\frac{dN_p}{dt}B_g + \frac{dW_p}{dt}B_w$$

$$W_e = (c_w + c_f)\,W_i\,(p_i - p)$$

$$p_{pc} = 677 + 15\gamma_g - 37.5\gamma_g^2$$

$$\gamma_g = \frac{M_a}{M_{air}} = \frac{M_a}{28.96}$$

$$W_i = \left[\frac{\pi\left(r_a^2 - r_e^2\right)h\phi}{5.615}\right]$$

$$\frac{dW_e}{dt} = e_w = \left[\frac{0.00708kh}{\mu_w In\left(\frac{r_a}{r_e}\right)}\right](p_i - p)$$

$$Gas\ FVF = 0.005035\frac{zT}{P}$$

$$W_e = C\sum_0^t(\Delta p)\Delta t$$

$$W_e = C\left[\int_0^t (p_i - p)dt\right]$$

$$K = \frac{(9.4 + 0.02M_a)T^{1.5}}{209 + 19M_a + T}$$

$$E_D = \frac{V_p(S_{oi} - S_{or})}{V_pS_{oi}} = \frac{S_{oi} - S_{or}}{S_{oi}}$$

$$\rho_g = \frac{pM_a}{zRT}$$

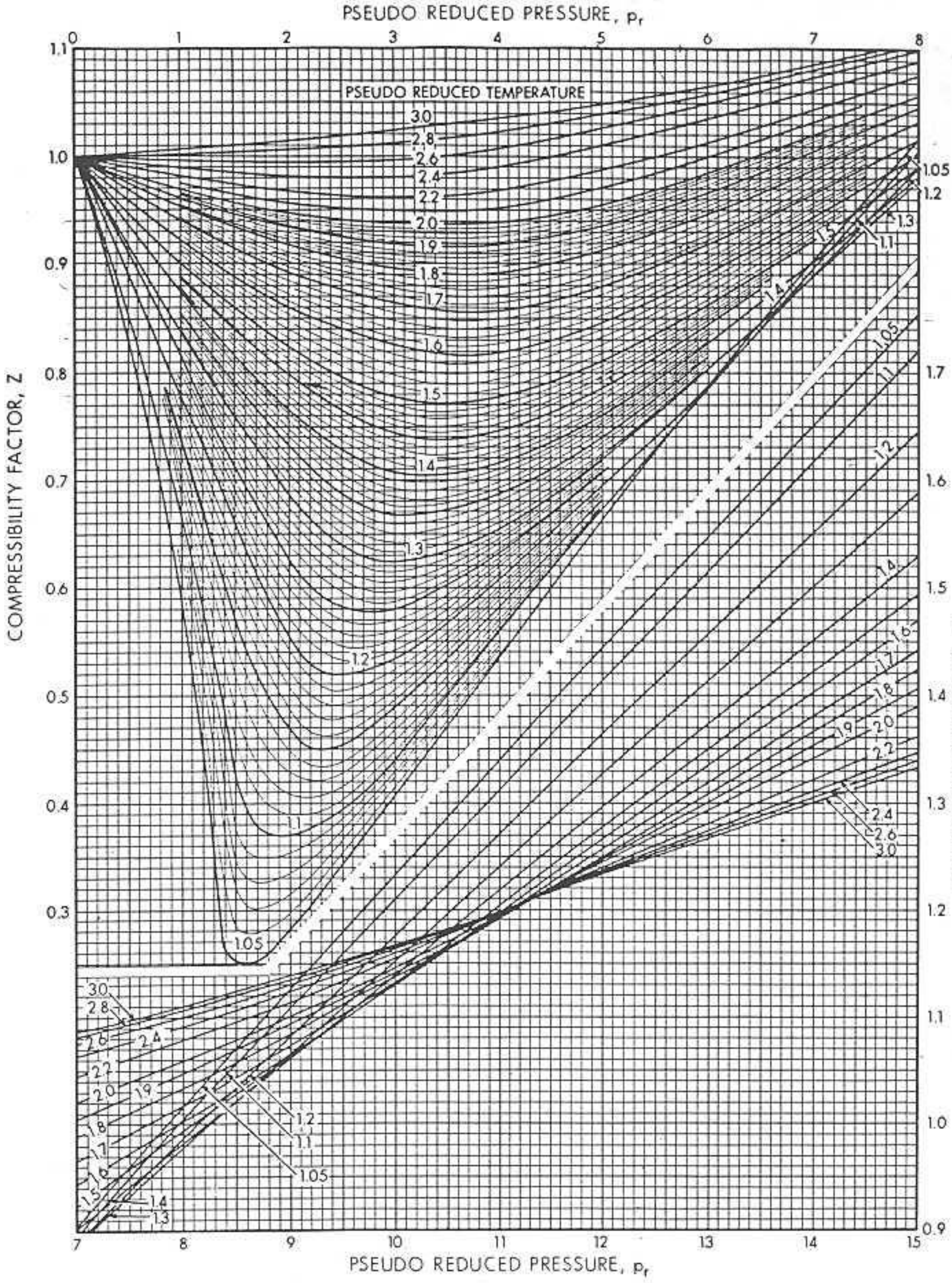
$$\mu_g = 10^{-4}K\exp\left[X\left(\frac{\rho_g}{62.4}\right)^Y\right]$$

$$X = 3.5 + \frac{986}{T} + 0.01M_a$$

$$Y = 2.4 - 0.2X$$

$$\gamma_g = \frac{\rho_g}{\rho_{air}}$$

AMARFIO ERIC MENSAH


PSEUDO REDUCED PRESSURE, p_r
PSEUDO REDUCED TEMPERATURE
COMPRESSIBILITY FACTOR, Z
COMPRESSIBILITY FACTOR, Z
PSEUDO REDUCED PRESSURE, p_r