كلية الهندسة – جامعة مصراتة

القسم / الهندسة النفطية
الزمن / (3) ثلاث ساعات
أستاذ المادة / أ. ونيس هويدي

الامتحان النهائي

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المقرر / هندسة مكامن غاز طبيعي
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أجب عن جميع الأسئلة الآتية:

Q-1) A gas reservoir with a gas specific gravity of 0.8 , If the reservoir pressure is 2925 psia and the gas Deviation factor (Z) is 0.9 . Calculate

1- Gas molecular weight. (2 marks)
2- Reservoir temperature. (4 marks)
3- Molar volume. (3 marks)
4- Gas density. (3 marks)
5- Gas formation volume factor. (3 marks)

Q-2) A wet gas is produced through a two-stage separator system. The 555 psia-89°F separator produces 170,516 scf/STB, and the 70°F stock tank produces 492 scf/STB. The stock tank liquid has a gravity of 64.7°API. The compositions of the surface production are given bellow.

1- Calculate the composition of the reservoir gas. (12 marks)
2- Calculate the wet gas formation volume factor (B_{wg}), if (Z) factor is 0.85. (6 marks)

Comp.	M_i	Composition, Separator gas, Mole fraction	Composition, Stock tank gas, Mole fraction	Composition, Stock tank liquid, Mole fraction				
C_1	16	0.8943	0.4615	0.0026				
C_2	30	0.0518	0.1218	0.0042				
C_3	44	0.0313	0.1845	0.0234				
i-C_4	58	0.0043	0.0373	0.0134				
n-C_4	58	0.0103	0.1020	0.0499				
i-C_5	72	0.0028	0.0327	0.0424				
n-C_5	72	0.0032	0.0384	0.0629				
C_6	86	0.0018	0.0206	0.1244				
C_{7+}	111*	0.0002	0.0012	0.6768				
		1.0000	1.0000	1.0000				

Q-3) A pressure build-up test was run on a gas well in a newly discovered reservoir. Determine the permeability and pressure drawdown due to skin using adjusted variables method. (10 marks)

Time (Hours)	Shut-in pressure (psia)	Adjusted pressure (psia)	Adjusted time ratio	
0.788	6834.7	5365.5	3464.2	
3.86	7586.0	6134.1	648.42	
18.9	8065.6	6622.3	122.80	
92.4	8389.8	6950.7	24.677	
204	8534.9	7097.2	11.519	
1000	8777.6	7341.3	3.0794	

These data aso available:

h = 21 ft	T_p = 2000 hr	μ_g = 0.03403	P_i = 9000 psia	γ_g = 0.85
R_w = 0.365 ft	q_g = 100 Mscf/d	C_t = 35.6x10^{-6} psia^{-1}	$P_{a,I}$ = 756 psia	S_w = 0.3
Φ = 0.10	T = 210 F	B_g = 0.4973 bbl/STB	Z = 1.325	

Q-4) Estimate the initial stabilized AOF potential of a well having the well and reservoir properties listed below. Use both the Rawlins-Schellhardt and the Houpeurt analysis techniques. In addition, estimate the AOF potential 10 years later when the static drainage area pressure has decreased to 350 psia. Evaluate the AOF potential at Pb = 14.65 psia. The following table summarizes the flow-after-flow test data.

γ = 0.715, L = 3050 ft, r_w = 0.5 ft, M_a = 20.71 lb_m/lb-mol. , A = 640 Ac., Φ = 0.25, $T_{f,wf}$ = 90 F, C_A = 30.8828, h = 200 ft.

$P_p(P=350)$ = 1.2239*10^7 psia^2/cp. $P_p(P_b)$ = 2674.8 psia^2/cp. (10 marks)

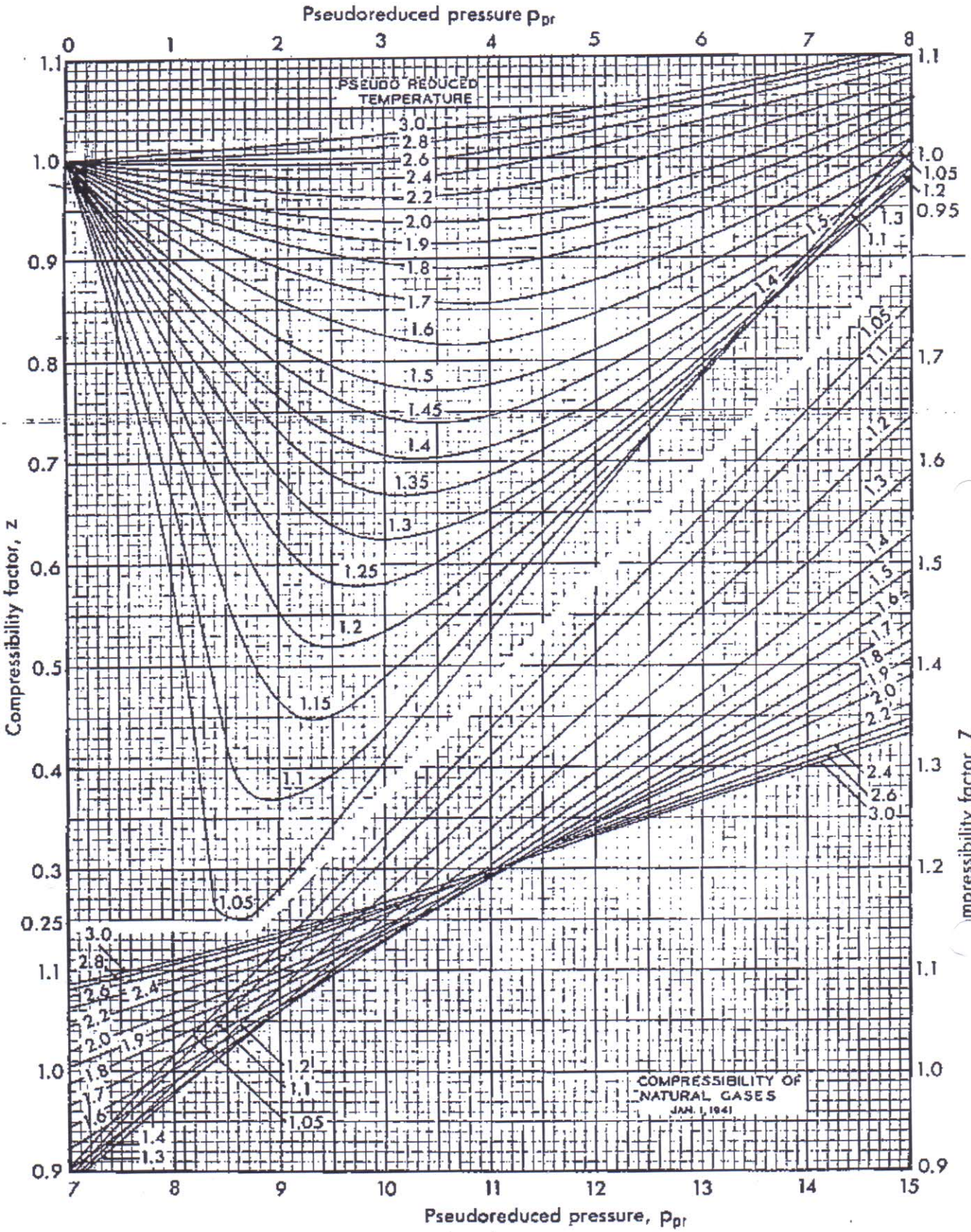
Flow rat MMscf/D	T_f F	Flowing bottomhole pressure pressure (psia)	Pseudopressure Psia^2/cp	
0.000	75	407.6	1.6173x10^7	
4.288	70	403.13	1.5817x10^7	
9.265	73	393.03	1.5032x10^7	
15.552	77	375.79	1.3736x10^7	
20.177	77	359.87	1.2591x10^7	

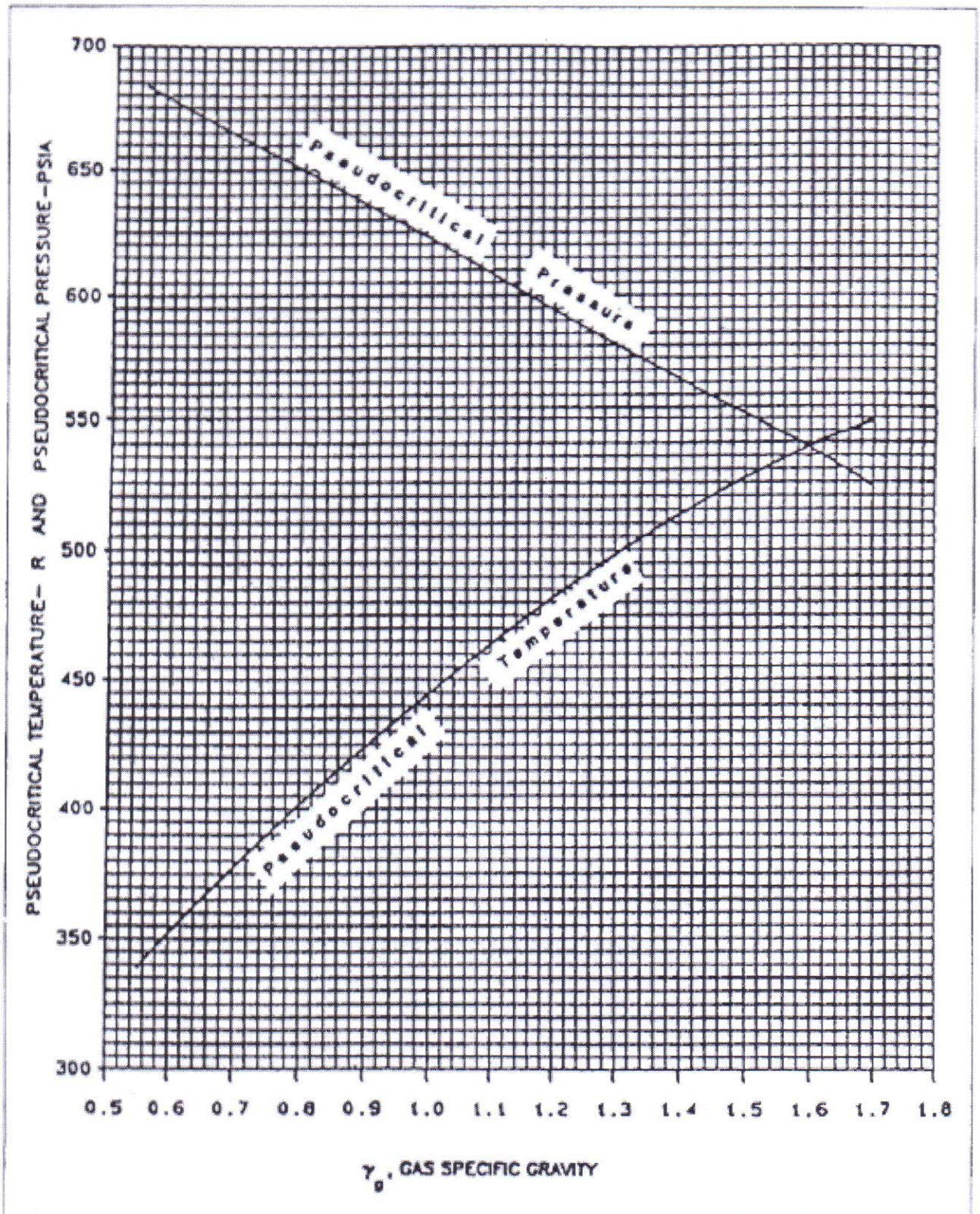
Q-5) For the following data taken from an abnormally pressured reservoir, estimate the original gas in place using the material balance equation. (7 marks)

P psia	Z	Gp MMscf		
9507	1.440	0		
8595	1.418	392.5		
7603	1.239	7538.1		
6721	1.147	11,758.9		
4295	0.928	28,144.6		
3750	0.891	32,566.7		
3247	0.854	36,819.9		

---------- انتهت الأسئلة ----------

$$k = \frac{162.6 q_{last} \bar{B}_g \bar{\mu}_g}{mh}, \quad s' = \left[1.151 \frac{(p_{a,1hr} - p_{a,ws})}{m} - \log\left(\frac{k}{\phi \bar{\mu}_g \bar{c}_t r_w^2} \right) + 3.23 \right].$$


Pseudoreduced pressure p_{pr}
PSEUDO REDUCED TEMPERATURE
3.0
2.8
2.6
2.4
2.2
2.0
1.9
1.8
1.7
1.6
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
Compressibility factor, z
Compressibility factor, Z
COMPRESSIBILITY OF NATURAL GASES
JAN. 1, 1941
Pseudoreduced pressure, p_{pr}



Pseudocritical properties of natural gases (after Sutton[7]).