UNIVERSITY OF IBADAN
FACULTY OF TECHNOLOGY
DEPARTMENT OF PETROLEUM ENGINEERING
B.Sc DEGREE FINAL EXAMINATIONS
2016/2017 FIRST SEMESTER EXAMINATIONS JULY 2017 TIME: 8.00AM
COURSE: RESERVOIR ENGINEERING I TPE 418
INSTRUCTIONS: ANSWER ALL QUESTIONS TIME ALLOWED: 3HRS

1. (a) List 5 characteristics of solution gas drive (5 marks)
   (b) A reservoir has the following pressure and PVT data:

Pressure (psia)	Bo (rb/stb)	Rs (scf/stb)	Bg rb/scf
4500 (pi)	1.3417	620	
4000	1.3480	620	
3830 (pb)	1.3511	620	.00087
3500	1.3222	560	.00096
3200	1.3022	500	.00107
2900	1.2822	452	.00119
2600	1.2633	404	.00137
2300	1.2450	357	.00161
2000	1.2287	314	.00196
1700	1.2115	267	.00249
1400	1.1940	222	.00339
1000	1.1763	108	.00519
800	1.1583	65	.01066
300	1.0520	20	.01122

   i. Is the reservoir saturated or undersaturated? Explain. (5 marks)
   ii. Determine the fractional oil recovery, during depletion down to bubble point pressure, given that $cw = 3.0 \times 10^{-6}$ /psi, Swc = 0.20, $cr = 8.6 \times 10^{-6}$ /psi (5 marks)
   iii. If the reservoir will be produced down to an abandonment pressure of 900 psia, determine an expression for the recovery at abandonment as a function of the cumulative gas oil ratio Rp. (5 Marks)
   iv. It is planned to initiate a water injection scheme in the reservoir. The intention is to maintain pressure at the level of 2700 psia (pb = 3330 psia). If the current producing gas oil ratio of the field (R) is 3000 scf/stb, what will be the initial water injection rate required to produce 15,000 stb/d of oil? (5 marks)

2. (a) List three uses and 2 limitations of the Material Balance Equation. (5 marks)
   (b) A reservoir has the following pressure and production data. ***Using the appropriate (graphical) technique*** of Havlenah and Odeh, determine the initial oil in place and the gas cap size (15 marks).

Pressure (Psia)	Np MMstb	Rp scf/stb	Bo rb/stb	Rs scf/stb	Bg rb/scf
3330 (pi = pb)			1.2511	510	.00087
3150	3.295	1050	1.2353	477	.00092
3000	5.903	1060	1.2222	450	.00096
2850	8.852	1160	1.2122	425	.00101
2700	11.503	1235	1.2022	401	.00107
2550	14.513	1265	1.1922	375	.00113
2400	17.730	1300	1.1822	352	.00120

3. a) Explain why oil reservoirs producing under water drive will normally have high recovery factors while water drive in gas reservoirs lead to low recovery factors. (10 marks)

b) Given the following data for a reservoir, estimate the stock tank oil initially in place and the water Influx constant in bbls/month/psi, assuming steady state water encroachment. (Bw = 1.02 rb/stb). (15 marks)

Time (years)	Pressure (psia)	Np (btb)	Wp (bbl)	Gp (MMscf)	Bo (rb/stb)	R s (scf/stb)	Bg (Cu ft/scf)
0	3000=Pb	0	0	0	1.350	500	0.0059
2	2750	6,826,800	160,000	3890	1.302	395	0.0083
4	2550	15,376,000	490,000	12150	1.250	350	0.0090

Differentiate between ***volumetrically-controlled*** and ***hydraulically-controlled*** reservoirs (5 marks)

) The initial volume in place in a reservoir was calculated by volumetric method to be 300 MMMscf underlying 2500 productive acres at an initial pressure of 3600 psia and 130°F. The pressure-production history is:

Pressure, psia	Production, MMMscf	Gas Deviation Factor at 130°F
3600	0.00	0.86
2700	78.00	0.80

i. Calculate the initial free gas in place assuming no water influx. (4 marks)

ii. Assuming uniform porosity, sand thickness and water saturation, if the volume of gas in place estimated from the pressure-production history is believed to be correct, how many acres of extension to the reservoir is predicted? (8 marks)

iii. If however the volumetric estimate is believed to be correct, how much water influx occurred during the 78 MMM scf production from the reservoir to ensure agreement between the volumetric and material balance methods? (8 marks)

Note: All the terms and abbreviations have the usual connotations