

# Introduction to Petroleum Engineering (Production)

## Assignment#01 (Well Deliverability)

Total Mark: 100%

Assume that oil is being produced from a well that is deviated  $45^\circ$  from vertical, oil gravity is ... (see next page), the internal diameter of tubing is ID=1.5 in. with a relative roughness of 0.008. It is a single phase oil reservoir with very low  $p_b$ . Reservoir operates under pseudo steady-state condition.

$k_H = \dots$  (see next page),  $k_V = 10 \text{ md}$ ,  $h = 40 \text{ ft}$ ,  $\bar{p} = 4500 \text{ psi}$ ,  $\mu = 5 \text{ cp}$ ,

$B = 1 \text{ RB/STB}$ ,  $\phi = 0.19$ ,  $S_w = 0.34$ ,  $r_w = 0.328 \text{ ft}$ ,  $s=0$ ,  $r_e = 4000 \text{ ft}$ ,  $L=10000 \text{ ft}$

- 1- Calculate flow rate from the reservoir to wellbore for different bottomhole pressures ( $p_{wf}=0$ ,  $p_{wf}=300 \text{ psi}$ ,  $1000 \text{ psi}$ ,  $1800 \text{ psi}$ ,  $3000 \text{ psi}$ ). State all the calculations. (15%)
- 2- Plot the IPR curve (5%)
- 3- Develop VLP curve for the wellhead pressure of 20 psi, at least, with five points ( $q=1 \text{ STB/day}$ , three by your choice, and maximum flow rate obtained for  $p_{wf}=0$ ). State all the calculations. (15%)
- 4- What will be the expected production rate and the corresponding  $p_{wf}$ , if the wellhead pressure is 20 psi? (5%)
- 5- Plot another IPR curve by assuming average reservoir pressure drops from 4500 psi to 3500 and calculate well deliverability for the new condition; use the VLP obtained in part#3. State all the calculations and describe your findings (15%)
- 6- Plot different IPR curves by assuming different well skin factors -3 and 25, and calculate well deliverability for each of them; use the VLP obtained in part#3. State all the calculations and describe your findings (20%)  
 $\bar{p} = 4500 \text{ psi}$ ,
- 7- Plot a new VLP curve and calculate well deliverability, for the base case, (average reservoir pressure of 4500, and skin factor of zero), if the tube is replaced by a new one with relative roughness of 0.00005 and diameter of 2 in. State all the calculations and describe your findings (25%)

<b>Set#</b>	<b>Density (lb<sub>m</sub>/ft<sup>3</sup>)</b>	<b>Permeability (md)</b>
1	49	80
2	49	85
3	49	90
4	49	95
5	50	80
6	50	85
7	50	90
8	50	95
9	51	80
10	51	85
11	51	90
12	51	95
13	52	80
14	52	85
15	52	90
16	52	95
17	53	80
18	53	85
19	53	90
20	53	95