PSet 2

1) V_{out} theoretical = 2.50 V

V_{out} measured = 2.57V

I_1 calculated = 2.50 mA

I_2 calculated = 2.50 mA

$V = IR$ $R_{eq} = \Sigma R = 2 \cdot 10^3 \Omega$

$V = 2.57$ V

$I = V/R$

$\quad = 2.57 / (2 \cdot 10^3)$

$\quad = 1.24$ mA

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2) V_{out} theoretical = 2.62V

V_{out} measured = 2.71 V

I_1 calculated = 2.38 mA

I_2 calculated = 2.38 mA

I_3 calculated = 2.38 mA

$V_{out} = \dfrac{V_{in} \cdot R_{out}}{R_{total}}$

$\quad = \dfrac{5 \cdot 1100}{2100} = \dfrac{55}{21} = 2.62V$

$I = V/R = \dfrac{5}{2100}$

$\quad = 2.38$ mA

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3) $R_{eq} = 1100 \Omega$

$V_{out} = \dfrac{R_{out} \cdot V_{in}}{R_{total}} = \dfrac{90.91 \cdot 5}{1090.91}$

$\quad = 0.416 V$

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4) V_{out} theoretical = 0.416V

V_{out} measured = 0.404 V

I_1 calculated = 4.58 mA

I_2 calculated = 0.42 mA

I_3 calculated = 4.17 mA

$R_p = \dfrac{1}{\Sigma \frac{1}{R}} = \dfrac{1}{\frac{1}{100} + \frac{1}{1000}} = \dfrac{1}{\frac{11}{1000}}$

$\quad = \dfrac{1000}{11} = 90.91 \Omega$

$R_{total} = 1000 + 90.91 = 1090.91 \Omega$

$I_1 = V/R_{total} = \dfrac{5}{1090.91}$

$\quad = 4.58$ mA

$I_2 = I_1 \cdot \dfrac{100}{1100} = I_1 \cdot \dfrac{1}{11} = 0.42$ mA

$I_3 = I_1 \cdot \dfrac{1000}{1100} = I_1 \cdot \dfrac{10}{11} = 4.17$ mA

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5) 5V

$1k\Omega$

— V_{out}

R_{eq}

$R_{eq} = \dfrac{1}{\frac{1}{100} + \frac{1}{1000}} = \dfrac{1000}{11} = \boxed{90.91 \Omega}$

6) V_{out} theoretical = 2.49 V

V_{out} measured = 2.57 V

I_1 calculated = 2.51 mA

I_2 calculated = 2.49 mA

I_3 calculated = 0.02 mA

$R_p = \dfrac{1}{\frac{1}{10^3}+\frac{1}{10^5}} = \dfrac{1}{\frac{100}{10^5}+\frac{1}{10^5}} = \dfrac{10^5}{101} = 990.1\,\Omega$

$R_{total} = 1000 + 990.1 = 1990.1\,\Omega$

$V_{out} = \dfrac{R_{out}\cdot V_{in}}{R_{total}} = \dfrac{990.1\cdot 5}{1990.1} = 2.49\,V$

$I_1 = V/R_{total} = \dfrac{5}{1990.1} = 2.51\,mA$

$I_2 = I_1 \cdot \dfrac{R_3}{R_{out}} = 2.51\,mA \cdot \dfrac{10^5}{101000} = 2.49\,mA$

$I_3 = I_1 \cdot \dfrac{R_2}{R_{out}} = 251\,mA\,\dfrac{1000}{101000} = 0.02\,mA$

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7)

V_{out} theoretical max = 2.54 V   min = 2.44 V

V_{out} measured max = 2.64 V   min = 2.53 V

$R_{P_{max}} = 10\,\Omega$

$R_{P_{min}} = 0\,\Omega$

$V_{out} = \dfrac{R_{out}\cdot 5}{R_{total}}$

$V_{out\,min} = \dfrac{115\cdot 5}{236} = 2.4\,V$

$V_{out\,max} = \dfrac{125\cdot 5}{246} = 2.54\,V$