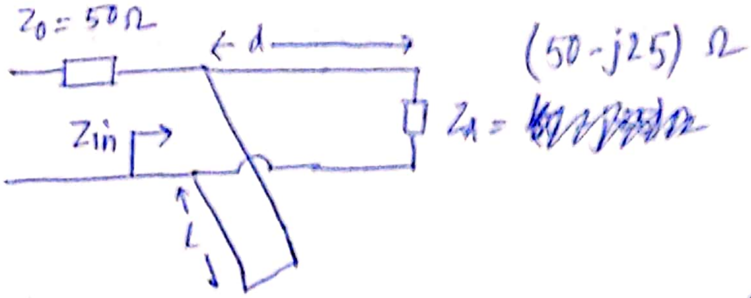
1a)



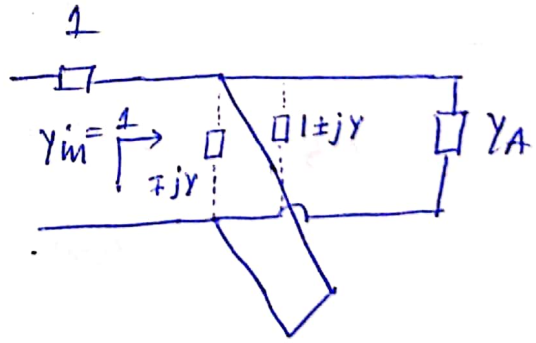

The shunt short circuited stub is used to match the antenna load impedance with that of the transmission line. Hence, the required Zin should be $Z_0 = 50\Omega$. We have the shorted stub and length (d) from the load to transform the antenna to an equivalent impedance of $Z_{in} = 50\Omega$.

$$Z_A = \frac{50-j25}{50} = 1-j0.5.$$

A straight line passing through center (O) ~~and~~ such that $OY_A = OZ_A$ gives the antenna admittance of $Y_A = 0.8+j0.4$.

We know, the input impedance ($Z_{in}$) or input ($Y_{in}$) has input conductance of ($G_{in} = 1$). Hence, draw ($G=1$) circle on Smith's chart.

The points where the circle ~~of~~ with radius $OZ_A$ for load and ($G=1$) circle meet provide two possible solutions for length of the transmission line (d).




As can be seen, $Y_A$ can now be transferred to either point A or B so as to give an admittance of ($Y_A' = 1 \pm jY$)

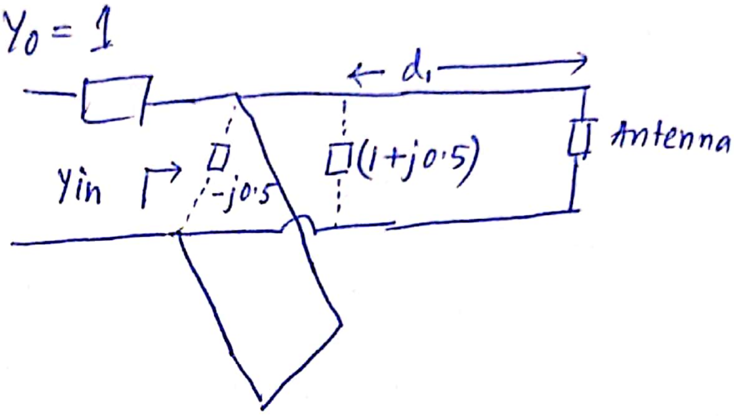
Length of transmission line to reach A $(d_1) = 0.039\lambda$.

Length of transmission line to reach B $(d_2) = 0.25\lambda$.

b) For point A

$Y_A' = 1 + j0.5$.

Hence, we need a stub of input admittance of $(-j0.5)$ to match the antenna with line




$Y_A' + Y_{stub_1} = Y_0$.

$Y_{stub_1} = Y_0 - Y_A'$

$= 1 - (1 + j0.5) = -j0.5$

Place $Y_{stub_1}$ in Smith' chart and find the length of the stub.

from the right extreme point.

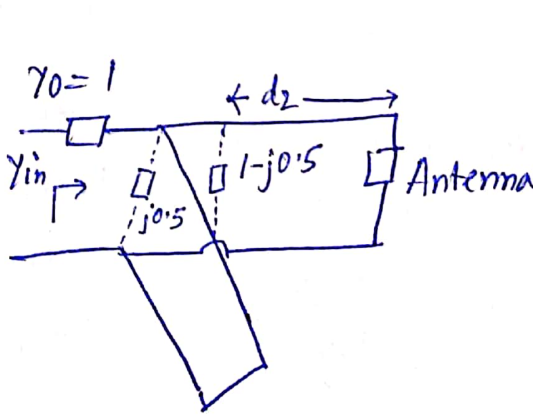
Length of stub $(Y_{stub1}) \Rightarrow l_1 = 0.176\lambda$

For point B

$Y_A' = 1 - j0.5$, $\quad Y_A' + Y_{stub_2} = Y_0$

$Y_{stub_2} = 1 - (1 - j0.5)$

$= j0.5$

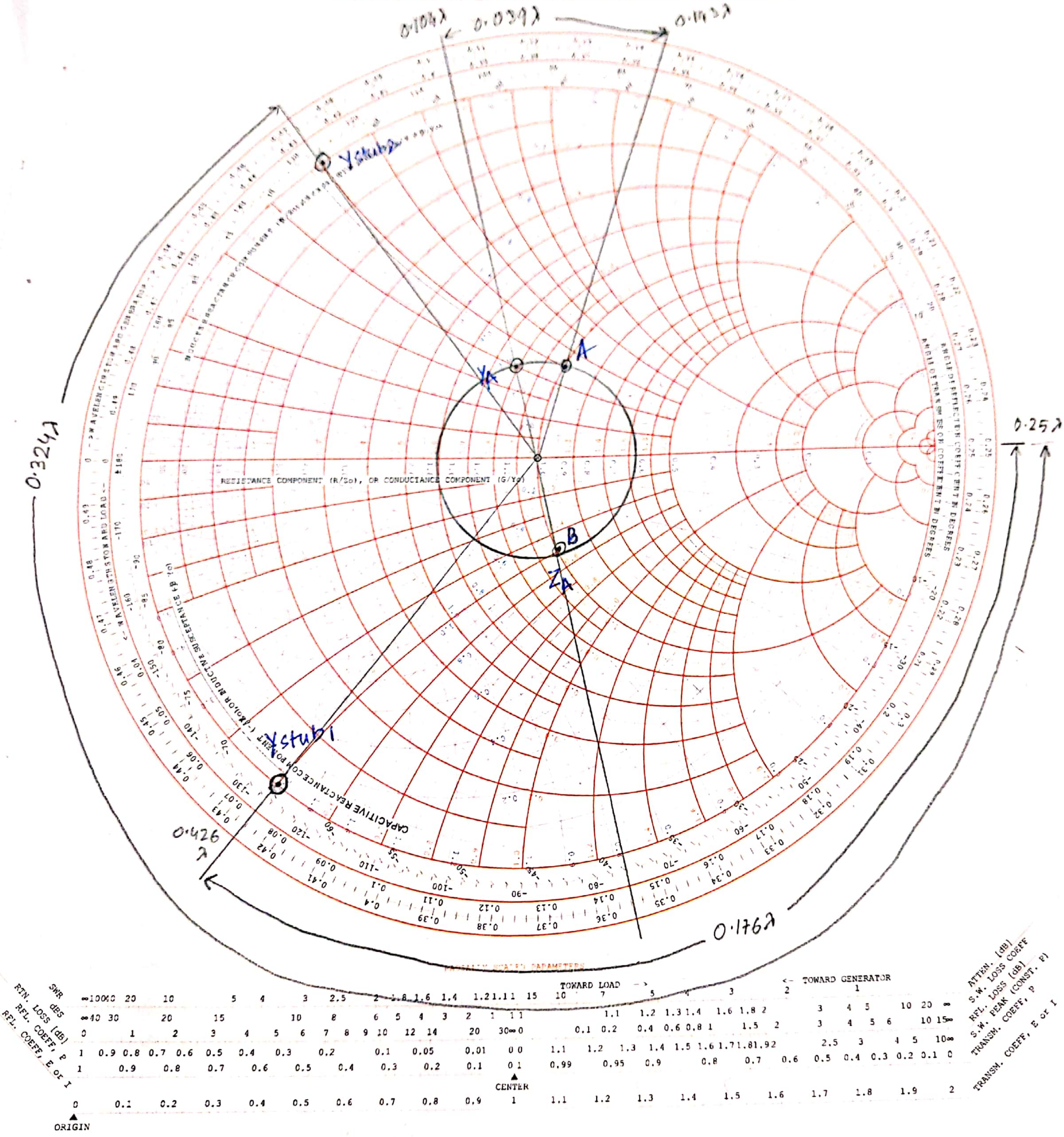



Length of $(Y_{stub2}) \Rightarrow l_2 = 0.324\lambda$.

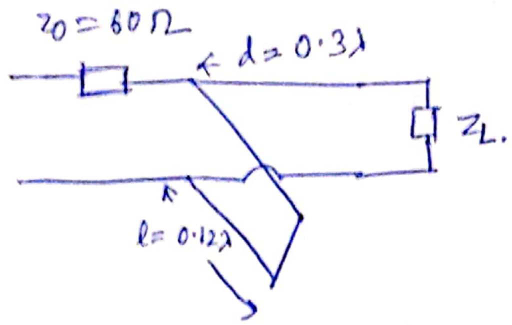
NAME Problem 1 TITLE DWG NO

SMITH CHART ENGS 120 COLOR BY J. COLVIN UNIVERSITY OF FLORIDA 1997 DATE

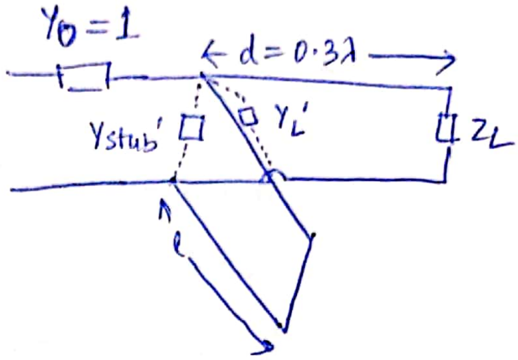
NORMALIZED IMPEDANCE AND ADMITTANCE COORDINATES



2:)




$Y_{stub}' = -j1.07$




$$Y_{stub}' + Y_L' = Y_0$$

$$Y_L' = Y_0 - Y_{stub}'$$

$$= 1 + j1.07.$$

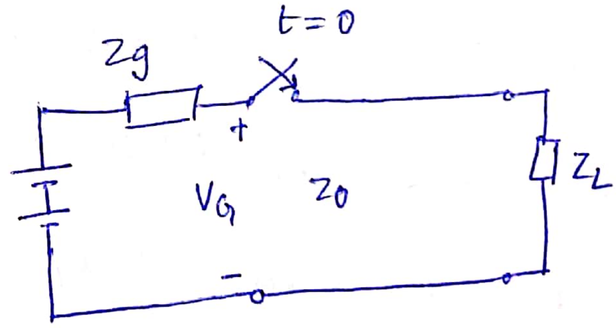
$Y_L'$ is shown in Smith Chart. Now, rotate $Y_L'$ towards load by $0.3\lambda$.

The load admittance is $Y_L$ (shown in Smith's chart)

$$Z_L = 0.58 + j0.7$$

$$= (0.58 + j0.7) \times 60 = (34.8 + j42)\,\Omega.$$

3:)




$$T = \frac{l}{u} = \frac{300}{3\times10^8} = 10^{-6}\,s = 1\,\mu s.$$

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{150-50}{150+50} = \frac{1}{2}$$

$$\Gamma_G = \frac{Z_g - Z_0}{Z_g + Z_0} = \frac{30-50}{150+50} = -\frac{1}{4}$$

$$V_1^+ = \frac{Z_0}{Z_g + Z_0} V_g = \left(\frac{50}{30+50}\right) 10 = 6.25\,V$$

NAME Problem2

TITLE

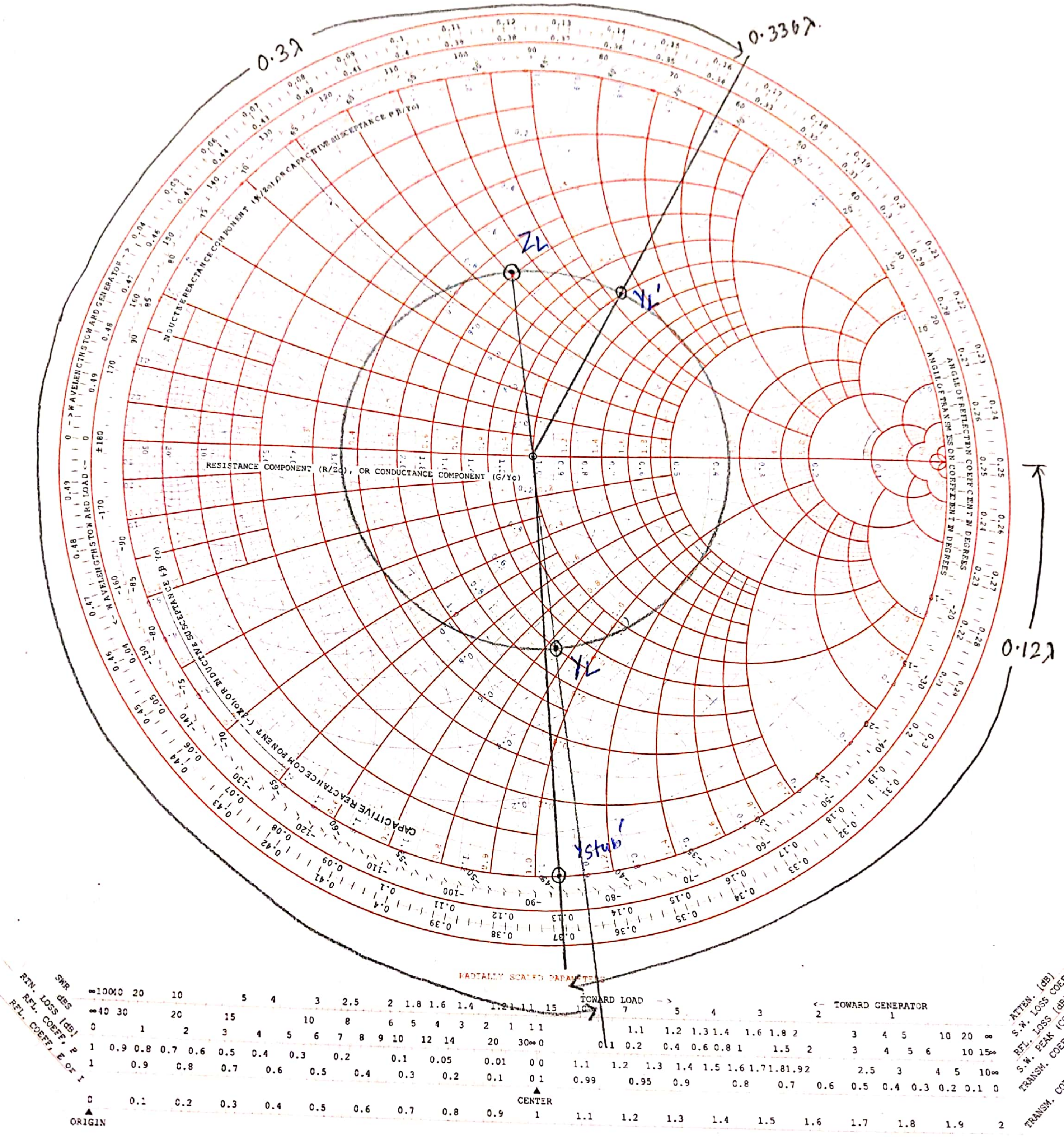
DWG. NO.

SMITH CHART ENGS 120

COLOR BY J. COLVIN, UNIVERSITY OF FLORIDA, 1997

DATE

NORMALIZED IMPEDANCE AND ADMITTANCE COORDINATES

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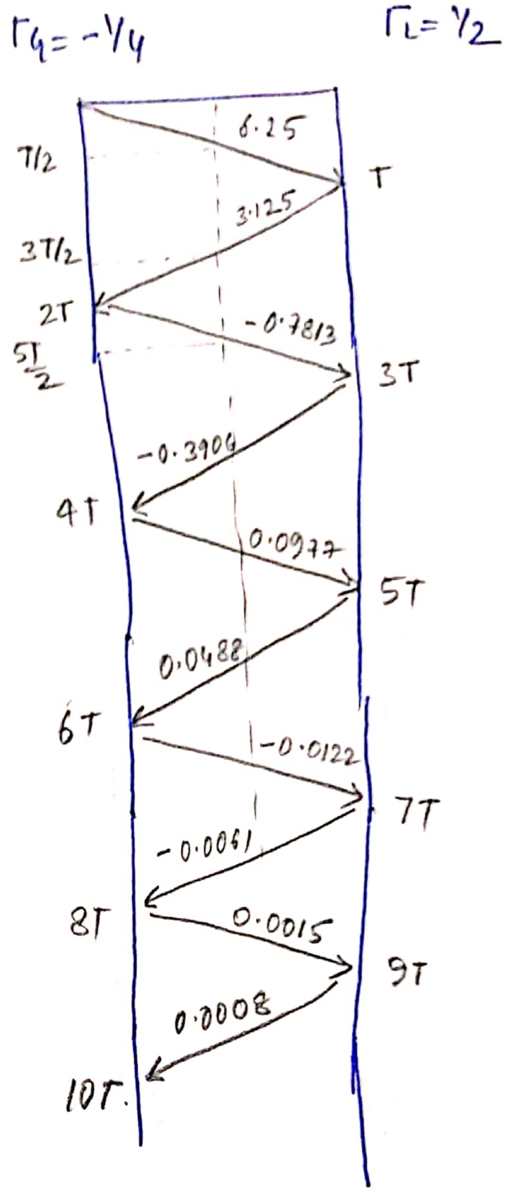
## ~~Plot~~ Bounce Diagram

$V_1^- = \Gamma_L \cdot V_1^+ = \frac{1}{2} \times 6.25 = 3.125\,V.$




$0 \le t < T/2, \; V_M = 0$

$T/2 \le t < 3T/2, \; V_M = 6.25\,V$

$3T/2 \le t < 5T/2, \; V_M = 6.25 + 3.125 = 9.375\,V$

$5T/2 \le t \le \frac{7T}{2} \quad V_M = 9.375 - 0.7813 = 8.5937\,V$

$7T/2 \le t < \frac{9T}{2} \quad V_M = 8.5937 - 0.3906 = 8.2031\,V.$

$9T/2 \le t < 11T/2 \quad V_M = 8.2031 + 0.0977 = 8.3008\,V.$

$11T/2 \le t < 13T/2 \quad V_M = 8.3008 + 0.0488 = 8.3496\,V.$

$13T/2 \le t < 15T/2 \quad V_M = 8.3496 - 0.0122 = 8.3374\,V.$

$15T/2 \le t < 17T/2 \quad V_M = 8.3374 - 0.0061 = 8.3313\,V$

$17T/2 \le t < 19T/2 \quad V_M = 8.3313 + 0.0015 = 8.3328\,V$

$19T/2 \le t < 21T/2 \quad V_M = 8.3328 + 0.0008 = 8.3336\,V$

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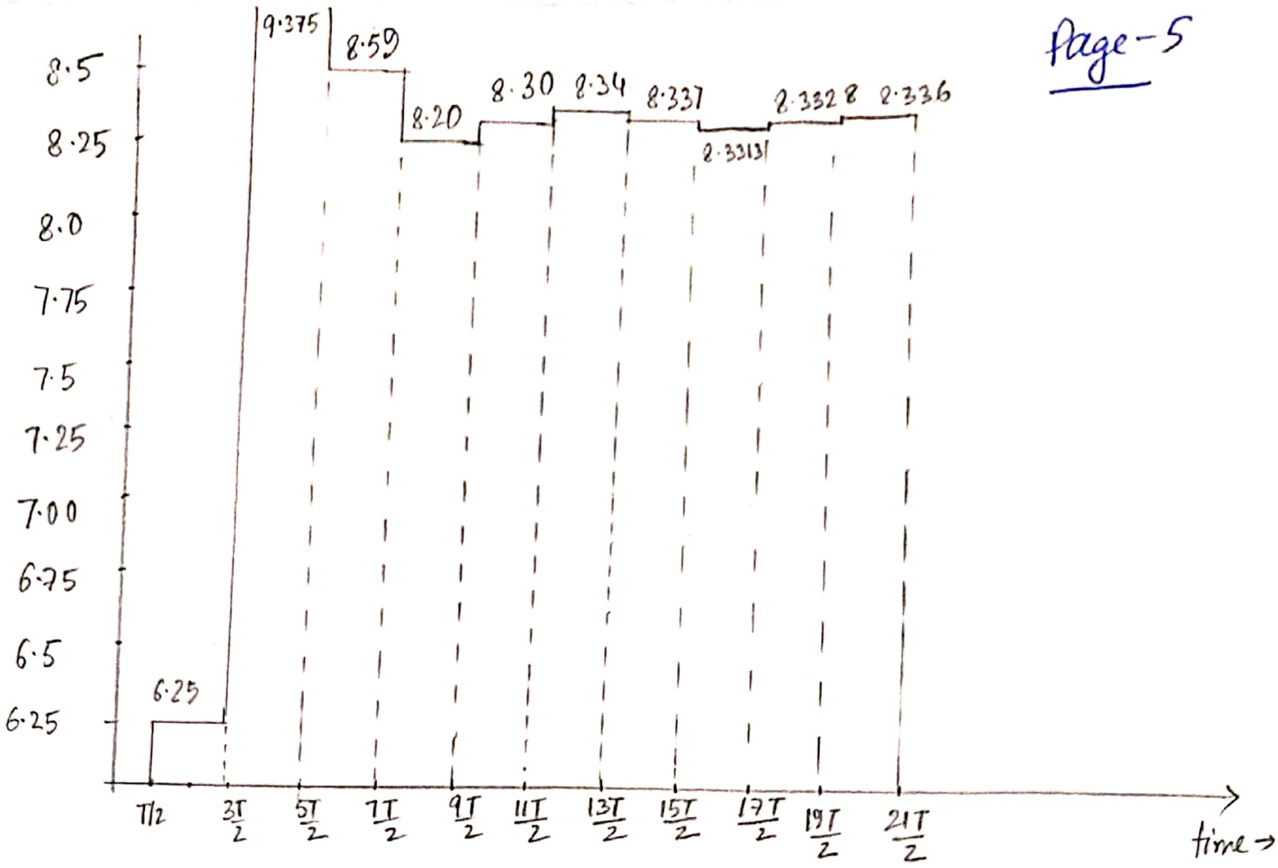



3b) $V_g = -10V$.

$0 \leq t < 2T$, $V_L = 0$

$2T \leq t < 4T$, $V_L = -6.25 - 3.125 = -9.375$ V.

$4T \leq t < 6T$, $V_L = -9.375 + 0.7813 + 0.3906$

$= -8.2031$ V.

$6T \leq t < 8T$, $V_L = -8.2031 - 0.0977 - 0.0488$

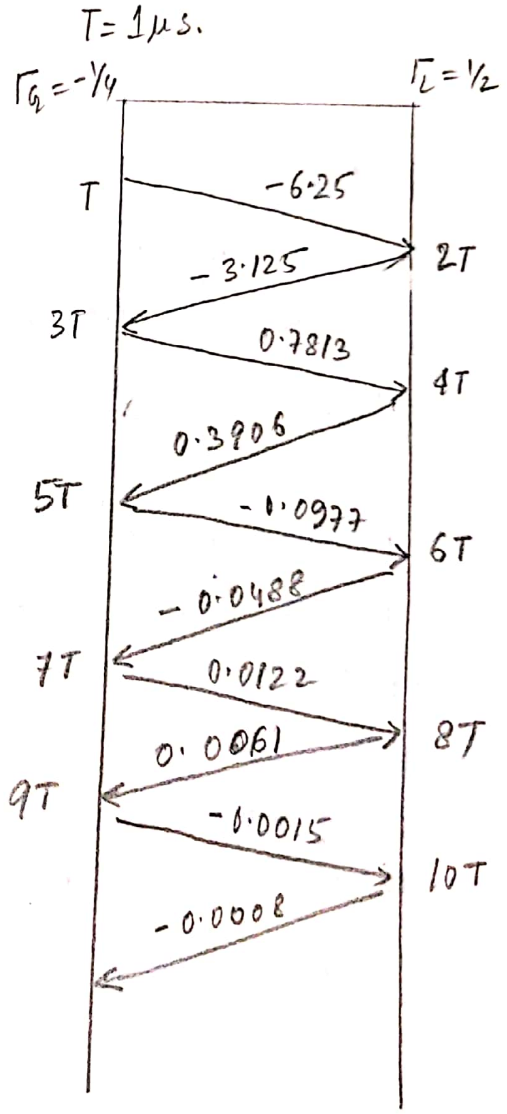
$= -8.3492$ V

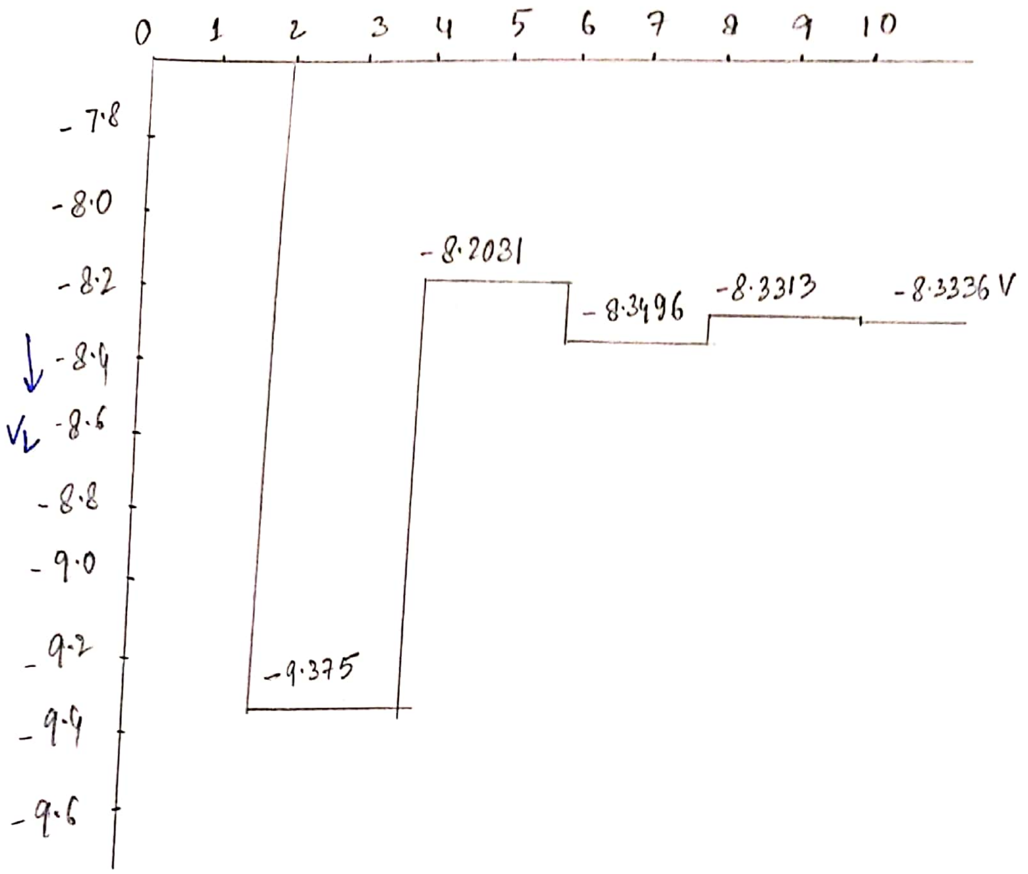
$8T \leq t < 10T$, $V_L = -8.3492 + 0.0122 + 0.0061$

$= -8.3312$ V

$10T \leq t < 12T$, $V_L = -8.3313 - 0.0015 - 0.0008$

$= -8.3336$ V.






3c) $T = 1\,\mu s.$

$0 \le t < T \Rightarrow V_L = 0.$

$T \le t < 2T \Rightarrow V_L = 9.375V$

$2T \le t < 3T \Rightarrow V_L = 0\ V.$

$3T \le t < 4T \Rightarrow V_L = 8.2031 - 9.375 = -1.1719V$

$4T \le t < 5T \Rightarrow V_L = 0\ V.$

$5T \le t < 6T \Rightarrow V_L = 8.3496 - 8.2031 = 0.1465V$

$6T \le t < 7T \Rightarrow V_L = 0\ V$

$7T \le t < 8T \Rightarrow V_L = 8.3313 - 8.3496 = -0.0183$

$8T \le t < 9T \Rightarrow V_L = 0$

$9T \le t < 10T;\ V_L = 8.3336 - 8.3313 = 0.00230V$

$10T \le t < 12T,\ V_L = 0$