Quiz #1

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Part A

Input range   0-5kg   overall error is $\pm$ 0.05mV
Output range   0 ~ 10 mV
Sensitivity Error   ?
Hysterisis Error   0.15% fso

$$r_{in} = |5 - \emptyset| = 5kg$$

$$r_{out} = |10 - \emptyset| = 10 \, mV$$

$$\% \, U_{H(max)} = \frac{|U_{H(max)}|}{r_{out}} \times 100 \%$$

$$0.15\% = \frac{|U_{H(max)}|}{10mV} \times 100\%$$

$$\frac{(10 \times 10^{-3} V)(0.15)}{100} = |U_{H(max)}|$$

$$|U_{H(max)}| = 0.015 \, mV$$

$$U_{H(max)} = \pm \, 0.015 \, mV$$

$$U_c = \left[U_1^2 + U_2^2 + U_3^2 + \ldots + U_M^2 \right]^{1/2}$$

$$U_c = \left[U_M + U_k \right]^{1/2}$$

$$0.05\,mV = \left[(0.015\,mV)^2 + U_u^2 \right]^{1/2}$$

$$0.0025 = 0.000225 + U_u^2$$

$$U_u = \sqrt{0.002275}$$

$$\underline{U_u = 0.0477\,mV}$$

$$\% \, U_{u(max)} = \left[U_{k(max)} / V_{out} \right] \times 100\%$$

$$\% \, U_{k(max)} = \left(0.0477\,mV / (10\,mV) \right) \times 100\%$$

$$\boxed{\% \, U_k = 0.477\% \; fso}$$

Part B

* first order

$y_0 = 7$ pH

$KA = 11$ pH

$t = 15s$

$y(t) = KA + (y_0 - KA) e^{-t/\tau}$

$(0.9)11 = 11 + (7 - 11) e^{-15/\tau}$

$9.9 - 11 = -4 e^{-15/\tau}$

$0.275 = e^{-15/\tau}$

$\ln(0.275) = -15/\tau$

$\tau = -15/\ln(0.275)$

$$\boxed{\tau \doteq 11.62 \ s}$$