MEEN 382 Basic Measurements
Exam 2 Formula Sheet

$$N = \sum_{i=0}^{n-1} d_i b^i$$

$$e = x_i - x_t$$

$$e_s = x_{avg} - x_t$$

$$e_r = |x_i - x_{avg}|$$

$$s = \frac{d(output)}{d(input)} = \frac{\Delta output}{\Delta input}$$

$$V_2 = aR\frac{5V}{1023}$$

$$V_2 = V_s\frac{R_2}{R_t+R_2}$$

$$R_t = R_2\left(\frac{5V}{V_2} - 1\right)$$

$$T = \frac{B}{ln\left(\frac{R}{R_1}e^{\frac{B}{T_1}}\right)}$$

$$B = \left(A'A\right)^{-1}A'Y$$

$$q = hA\left(T_{mouth} - T_{blub}\right) = mc\frac{dT}{dt}$$

$$T_{mouth} - T_{blub} = \frac{mc}{hA}\frac{dT}{dt}$$

$$\tau = \frac{mc}{hA}$$

$$\frac{x(t)-x_{ss}}{x_0-x_{ss}} = e^{\frac{-t}{\tau}}$$

$$\tau\dot{x}(t) + x(t) = x_{ss}\Phi(t)$$

$$\tau = \frac{x_{ss}-x_0}{\dot{x}(0)}$$

$$\bar{x} = \frac{x_1+x_2+\cdots+x_n}{n} = \sum_{i=1}^{n}\frac{x_i}{n}$$

$$\mu = \sum_{i=1}^{N}\frac{x_i}{N}$$

$$d_i = x_i - \bar{x}$$

$$S = \sqrt{\sum_{i=1}^{n}\frac{(x_i-\bar{x})^2}{n-1}}$$

$$\sigma = \sqrt{\sum_{i=1}^{N}\frac{(x_i-\mu)^2}{N}}$$

$$P(A\ or\ B) = P(A) + P(B)$$

$$P(AB) = P(A)\cdot P(B)$$

$$P(A\cup B) =$$
$$P(A) + P(B) - P(A)\cdot P(B)$$

$$\sum_{i=1}^{n} P(x_i) = 1$$

$$\mu = \sum_{i=1}^{N} x_i P(x_i)$$

$$P(a \le x \le b) = \int_a^b f(x)\,dx$$

$$\mu = \int_{-\infty}^{\infty} x f(x)\,dx$$

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}}e^{\frac{-(x-\mu)^2}{2\sigma^2}}$$

$$\nu = n - 1$$

$$f(t,\nu) = \frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\sqrt{\nu\mu}\,\Gamma\left(\frac{\nu}{2}\right)\left(1+\frac{t^2}{\nu}\right)^{\frac{\nu+1}{2}}}$$

$$\Gamma(n) = (n-1)!$$

$$y = kx^m$$

$$m = \frac{\log(y_2) - \log(y_1)}{\log(x_2) - \log(x_1)}$$

$$R = \frac{80}{\sqrt{L}}$$

$$L = \frac{6400}{R^2}$$

$$z = \frac{\bar{x}-\mu}{\sigma}$$

$$u_Y = \sqrt{\sum_{i=1}^{n}\left(u_{x_i}\frac{\partial Y}{\partial x_i}\right)^2}$$

$$P_{cr} = \frac{4\pi^2 EI}{L^2}$$

$$I = \frac{1}{12}b^4$$

$$\frac{\partial f}{\partial x} \approx \frac{\Im[f(x+ih)]}{h}$$

$$\dot{m} = CA\sqrt{\frac{2P_1}{RT_1}\Delta P}$$

$$V = mG + b$$

$$V = \left(3.125\times10^{-3}\right)G + 2.5$$

$$\mu = \bar{x} \pm \delta$$

$$\bar{x} - \delta \le \mu \le \bar{x} + \delta$$

$$C.L. = P\left(\bar{x} - \delta \le \mu \le \bar{x} + \delta\right)$$

$$C.L. = 1 - \alpha$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

$$z = \frac{\bar{x}-\mu}{\sigma_{\bar{x}}}$$

$$z = \frac{\bar{x}-\mu}{S/\sqrt{n}}$$

$$\mu = \bar{x} \pm z_{\frac{\alpha}{2}}\frac{S}{\sqrt{n}}$$

$$A = \frac{C.L.}{2}$$

$$z_{\frac{\alpha}{2}} = z_1 + z_2$$

$$t = \frac{\bar{x}-\mu}{S/\sqrt{n}}$$

$$\mu = \bar{x} \pm t_{\frac{\alpha}{2}}\frac{S}{\sqrt{n}}$$

$$A = \frac{1-C.L.}{2}$$

$$P_{\bar{x}} = \pm t\frac{S_x}{\sqrt{n}}$$

$$\bar{x}_{final} = \sum_{i=1}^{M}\frac{x_i}{M}$$

$$P_{\bar{x}_{final}} = \pm t\frac{S_x}{\sqrt{M}}$$

$$P_{\bar{x}_{final}} = \pm tS_x$$

$$u_x = \sqrt{B_x^2 + P_x^2}$$

$$u_{\bar{x}} = \sqrt{B_x^2 + P_{\bar{x}}^2}$$

$$f_s > 2f_m$$

$$f_N = \frac{f_s}{2}$$

$$D_o = int\left[\frac{V_i - V_{rl}}{V_{ru} - V_{rl}}\left(2^N - 1\right)\right]$$

$$V_i = D_o\left(\frac{V_{ru} - V_{rl}}{2^N - 1}\right) + V_{rl}$$

$$R_e = \pm 0.5\frac{V_{ru} - V_{rl}}{2^N - 1}$$

$$\epsilon = \frac{\frac{\Delta R}{R_o}}{GF}$$

$$\sigma = E\epsilon$$

$$I_{ABC} = \frac{V_s}{R_1 + R_4}$$

$$I_{ADC} = \frac{V_s}{R_p + R_g}$$

$$V_B = \frac{V_s R_4}{R_1 + R_4}$$

$$V_D = \frac{V_s R_g}{R_p + R_g}$$

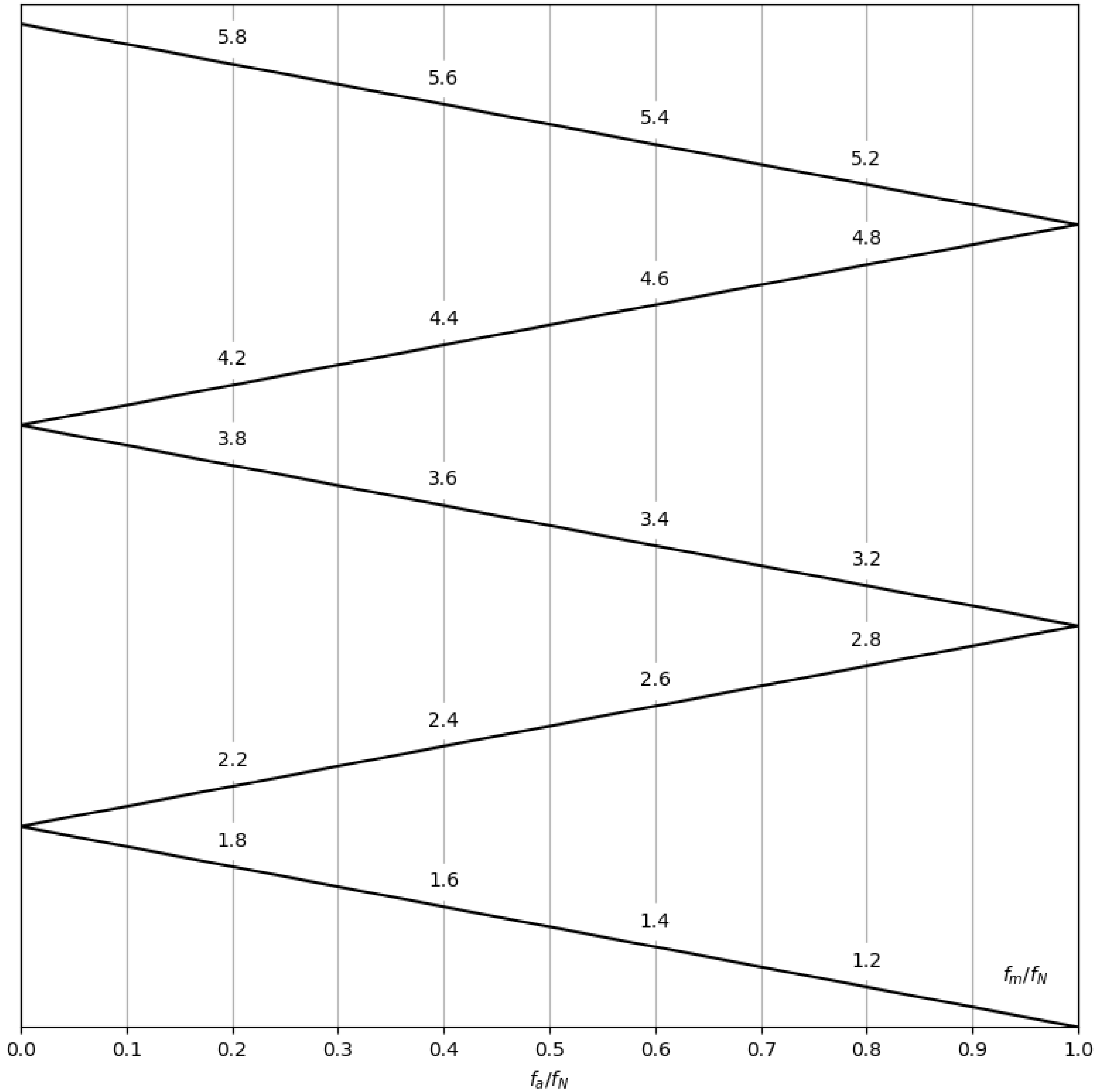
$$V_o = V_s\frac{R_1R_g - R_4R_p}{(R_p + R_g)(R_1 + R_4)}$$

$$V_o = V_s\frac{R_1(R_o + \Delta R_g) - R_4R_p}{(R_p + (R_o + \Delta R_g))(R_1 + R_4)}$$

$$\Delta R_g =$$
$$\frac{V_s(R_1R_o - R_4R_p) - V_o(R_1 + R_4)(R_p + R_o)}{V_o(R_1 + R_4) - V_sR_1}$$

$$V_o = V_{in}\left(1 + \frac{R_2}{R_1}\right)$$

$$gain = \left(1 + \frac{R_2}{R_1}\right)$$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2.8
2.6
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1.8
1.6
1.4
1.2
f_m/f_N
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
f_a/f_N