ELET 270 Instrumentation Exam 2 Formula Sheet

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| | |
| $N = \sum_{i=0}^{n-1} d_i b^i$ | $\mu = \sum_{i=1}^{N} x_i P\left(x_i\right)$ |
| $e = x_i - x_t$ | $P(a \le x \le b) = \int_{a}^{b} f(x) dx$ |
| $e_s = x_{avg} - x_t$ | $\mu = \int_{-\infty}^{\infty} x f(x) dx$ |
| $e_r = x_i - x_{avg} $ | $f(x) = \frac{1}{\sigma\sqrt{2\pi}}e^{\frac{-(x-\mu)^2}{2\sigma^2}}$ |
| $s = \frac{d(output)}{d(input)} = \frac{\Delta output}{\Delta input}$ | $\nu = n - 1$ |
| $V_2 = aR \frac{5V}{1023}$ | $f(t,\nu) = \frac{\Gamma(\frac{\nu+1}{2})}{\sqrt{\nu\mu}\Gamma(\frac{\nu}{2})(1+\frac{t^2}{\nu})^{\frac{\nu+1}{2}}}$ |
| $V_2 = V_s \frac{R_2}{R_t + R_2}$ | $\Gamma(n) = (n-1)!$ |
| $R_t = R_2 \left(\frac{5V}{V_2} - 1 \right)$ | $y = kx^m$ |
| $T = \frac{B}{ln\left(\frac{R}{R_1}e^{\frac{B}{T_1}}\right)}$ | $m = \frac{\log(y_2) - \log(y_1)}{\log(x_2) - \log(x_1)}$ |
| $B = (A'A)^{-1} A'Y$ | $R = \frac{80}{\sqrt{L}}$ |
| | $L = \frac{6400}{R^2}$ |
| $= hA\left(T_{mouth} - T_{blub}\right) = mc\frac{dT}{dt}$ | $z = \frac{\bar{x} - \mu}{\sigma}$ |
| $T_{mouth} - T_{blub} = \frac{mc}{hA} \frac{dT}{dt}$ | $u_Y = \sqrt{\sum_{i=1}^n \left(u_{x_i} \frac{\partial Y}{\partial x_i}\right)^2}$ |
| $	au = rac{mc}{hA}$ | $P_{cr} = rac{4\pi^2 EI}{L^2}$ |
| $\frac{x(t)-x_{ss}}{x_0-x_{ss}} = e^{\frac{-t}{\tau}}$ | $I = \frac{1}{12}b^4$ |
| $\tau \dot{x}(t) + x(t) = x_{ss}\Phi(t)$ | $\frac{\partial f}{\partial x} pprox \frac{\Im[f(x+ih)]}{h}$ |
| $\tau = \frac{x_{ss} - x_0}{\dot{x}(0)}$ | $\dot{m} = CA\sqrt{\frac{2P_1}{RT_1}\Delta P}$ |
| $\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n} = \sum_{i=1}^n \frac{x_i}{n}$ | V = mG + b |
| $\mu = \sum_{i=1}^{N} rac{x_i}{N}$ | $V = (3.125 \times 10^{-3}) G + 2.5$ |
| $d_i = x_i - \bar{x}$ | $\mu = \bar{x} \pm \delta$ |
| $S = \sqrt{\sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n - 1}}$ | $\bar{x} - \delta \le \mu \le \bar{x} + \delta$ |
| $\sigma = \sqrt{\sum_{i=1}^{N} \frac{(x_i - \mu)^2}{N}}$ | $C.L. = P(\bar{x} - \delta \le \mu \le \bar{x} + \delta)$ |
| P(A or B) = P(A) + P(B) | $C.L. = 1 - \alpha$ |
| $\mathbf{P}(A\mathbf{P}) = \mathbf{P}(A) = \mathbf{P}(\mathbf{P})$ | – σ |

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

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

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

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

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

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

$$\bar{c}$$

$$\bar{c} = \frac{x_{1} + x_{2} + \dots + x_{n}}{n} = \sum_{i=1}^{n} \frac{x_{i}}{n}$$

$$\mu = \sum_{i=1}^{N} \frac{x_{i}}{N} \qquad V = (3.$$

$$d_{i} = x_{i} - \bar{x}$$

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

$$\sigma = \sqrt{\sum_{i=1}^{N} \frac{(x_{i} - \mu)^{2}}{N}} \qquad C.L. = F$$

$$P(A \text{ or } B) = P(A) + P(B)$$

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

$$P(A \cup B) = \frac{1}{n} P(A \cup B) = \frac{1$$

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

$$\mu = \sum_{i=1}^{N} x_{i} P\left(x_{i}\right)$$

$$P\left(a \leq x \leq b\right) = \int_{a}^{b} f\left(x\right) dx$$

$$\mu = \int_{-\infty}^{\infty} xf\left(x\right) dx$$

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

$$\nu = n - 1$$

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

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

$$y = kx^{m}$$

$$m = \frac{\log\left(y_{2}\right) - \log\left(y_{1}\right)}{\log\left(x_{2}\right) - \log\left(x_{1}\right)}$$

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

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

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

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

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

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

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

$$\dot{m} = CA\sqrt{\frac{2P_{1}}{RT_{1}}}\Delta P$$

$$V = mG + b$$

$$V = (3.125 \times 10^{-3}) G + 2.5$$

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

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

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

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

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

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

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

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

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

$$z_{\frac{\alpha}{2}} = z_{1} + z_{2}$$

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

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

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

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

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

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

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

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

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$$t_s > 2f_m$$

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

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

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

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

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

$$\sigma = E\epsilon$$

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

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

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

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

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

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

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

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

$$gain = \left(1 + \frac{R_2}{R_1} \right)$$

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