ECE 302 Final Exam
Reference Formula

$$\Pr(A|B) = \frac{\Pr(B|A)\Pr(A)}{\Pr(B)} \qquad \Pr(B) = \sum_i \Pr(B|A_i)$$

$$p_n(k) = \binom{n}{k} p^k (1-p)^{n-k} \qquad p(m) = (1-p)^{m-1} p$$

$$F_Y(y) = \int_{x:g(x)\leq y} f_X(x)dx \qquad f_Y(y) = \sum_i^n f_X(x_n)\left|\frac{dx_n}{dy}\right|$$

$$F_X(x|X \in A) = \frac{\int_{-\infty}^{x} f_X(x')1_A(x')dx'}{\Pr(X \in A)} \qquad f_X(x|X \in A) = \frac{f_X(x)1_A(x)}{\Pr(X \in A)}$$

$$\Phi(x) = \int_{-\infty}^{x} \frac{1}{\sqrt{2\pi}} e^{-z^2/2} dz \qquad \mathbb{E}[X^n] = \frac{1}{j^n}\frac{d^n}{d\omega^n}\varphi_X(\omega)\Big|_{\omega=0}$$

$$F_{U,V}(u,v) = \iint\limits_{(x,y):g(x,y)\leq u,\, h(x,y)\leq v} f_{X,Y}(x,y)\,dxdy \qquad F_Z(z) = \iint\limits_{(x,y):g(x,y)\leq z} f_{X,Y}(x,y)\,dxdy$$

$$f_{U,V}(u,v) = f_{X,Y}(x(u,v),y(u,v))\left|\frac{\partial(u,v)}{\partial(x,y)}\right|^{-1} \qquad \frac{\partial(u,v)}{\partial(x,y)} = \begin{vmatrix} \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} \\ \frac{\partial v}{\partial x} & \frac{\partial v}{\partial y} \end{vmatrix}$$

$$\mu_{X|Y}(y) = \mu_X + \frac{\sigma_X}{\sigma_Y}\rho_{XY}(y-\mu_Y) \qquad \sigma^2_{X|Y} = \sigma^2_X(1-\rho^2_{XY})$$

$$\widehat{X}_{\mathrm{MAP}}(y) = \arg\max_x f_{X|Y}(x|y) \qquad \widehat{X}_{\mathrm{ML}}(y) = \arg\max_x f_{Y|X}(y|x)$$

$$\widehat{X}_{\mathrm{MSE}}(y) = \mathbb{E}[X|Y=y] \qquad \widehat{X}_{\mathrm{LMMSE}}(y) = \mu_X + \frac{\sigma_X}{\sigma_Y}\rho_{XY}(y-\mu_Y)$$

$$\mu_Y = \mu_X \int_{-\infty}^{\infty} h(s)ds = \mu_x H(0) \qquad R_Y(\tau) = R_X(\tau) * h(\tau) * \tilde{h}(\tau)$$

$$S_Y(f) = \left|H(f)\right|^2 S_X(f)$$

$$\frac{d}{dy}\int_{a(y)}^{b(y)} f(x)dx = f(b(y))\frac{db(y)}{dy} - f(a(y))\frac{da(y)}{dy}$$