

ECS455 2016 Formula Sheet - Use at Your Own Risk!

ID3	Some boxes that are over the 40-symbol limit may have been modified.	401	$1 + x^3 + x^4$ LFSR 4 block add after g3 and g4 etc shift
036	Two signals are Orthogonal if their inner product is zero.	405	OFDM form is often referred to as Discrete Multi-Tone(DMT)
083		446	
085	$s = [a,b] \rightarrow \text{FFT} \rightarrow S = [a+b, a-b]$ $h = [c,d] \rightarrow \text{FFT} \rightarrow H = [c+d, c-d]$	474	$c(x) = x^{n-k}m(x) + r(x)$ $\hat{s}_2 = \langle r, c^{(2)} \rangle / \langle c^{(2)}, c^{(2)} \rangle$
095		477	$s[n] = s[n(\frac{T_s}{N})] \quad 0 \leq n < N$
124	ICI (inter-channel interference)	553	Hadamard matrix : $H_N H_N^T = N I_N$
146	convolution $[1 \ 2 \ 3] * [4 \ 5 \ 6]$ $= 4 \ 13 \ 28 \ 27 \ 18$	558	OFDM, $\hat{s} = \sqrt{N} \text{IFFT}(S)$, s add cyclic prefix = x $y = x * h$, remove junk $y = r$
150	circular convolution $[1 \ 2 \ 3] \otimes [4 \ 5 \ 6]$ $= 31 \ 31 \ 28$	583	$H_{2N} = [H_N \ H_N; H_N \ -H_N]$
154	$[1 \ 2 \ 3 \ 0 \ 0] \otimes [4 \ 5 \ 6 \ 0 \ 0] = [1 \ 2 \ 3] * [4 \ 5 \ 6]$	616	$\langle x, y \rangle = \int_{-\infty}^{\infty} x(t)y^*(t)dt = \int_{-\infty}^{\infty} X(f)Y^*(f)df \equiv \langle X, Y \rangle$
160	No. of junk to remove = No. of cyclic prefix added (for a single time of convolution)	82646	Two signals are orthogonal if their inner product is 0.
161	Receiver $\underline{r} = \underline{x}^{\wedge}(1) + \underline{x}^{\wedge}(2)$ Recover $a1 = \frac{1}{4} \langle \underline{r}(1:4), \underline{c}^{\wedge}(4,2) \rangle$	92646	$\hat{s} = \text{int } \Psi_N^*$ TDMA/FDD sys./rad. chs. = simu. users
176	OFDM with Memoryless Channel $R_k = \frac{1}{\sqrt{N}} \text{FFT}\{r\}[n]$	674	UMTS = Universal Mobile Telecommunication System
196	$\{h \otimes x\}[n] = (h^* x)[n]$ for $0 \leq n \leq N - 1$	702	Kronecker Product $A2^*2 \otimes B2^*2 = [A1^*B1 \ A1^*B2 \ A2^*B1 \ A2^*B2$...]4*4
232		757	$H1 = [1], H2 = [1 \ 1; 1 \ -1]$ $H4 = H2 \otimes H2$
251		761	$r(t) = h(t) * s(t) + w(t) = \beta s(t) + w(t)$
292	x^*h cconv to conv add cyc prefix in front $x = (\text{no. ele } h) - 1$	845	
357	OVSF=Orthogonal variable spreading factor	862	DFT: $\bar{x} = \frac{1}{N} \Psi_N^* \bar{X} \leftrightarrow \bar{X} = \Psi_N \bar{x} \quad \Psi_N^{-1} = \frac{1}{N} \Psi_N^*$, $\Psi_N = e^{j2\pi \frac{nk}{N}}$
375	CDMA key eq, $s=1/N$ ((sC)C^AT) all rows of C are orthogonal	879	$R_x[\tau] = \sum_{n=-\infty}^{\infty} x[n]x[n-\tau]$ autocorrelation (shift+multiply+add)
391	$H_2 = [1 \ 1; 1 \ -1]; H_{2^k} = [H_{2^{k-1}} \ H_{2^{k-1}}; H_{2^{k-1}} \ -H_{2^{k-1}}]$	905	$R_x[\tau] = \sum_{n=-\infty}^{\infty} x[n]x[n-\tau]$; divided by T if periodic