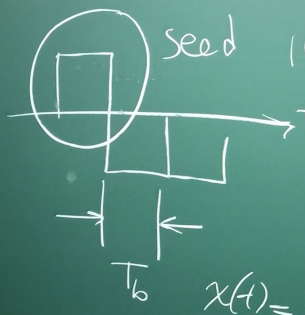
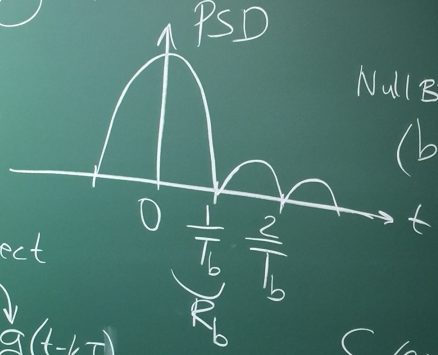
- Bandwith — Transmission Rate
- Factors affecting Rate

Jan 23/2018





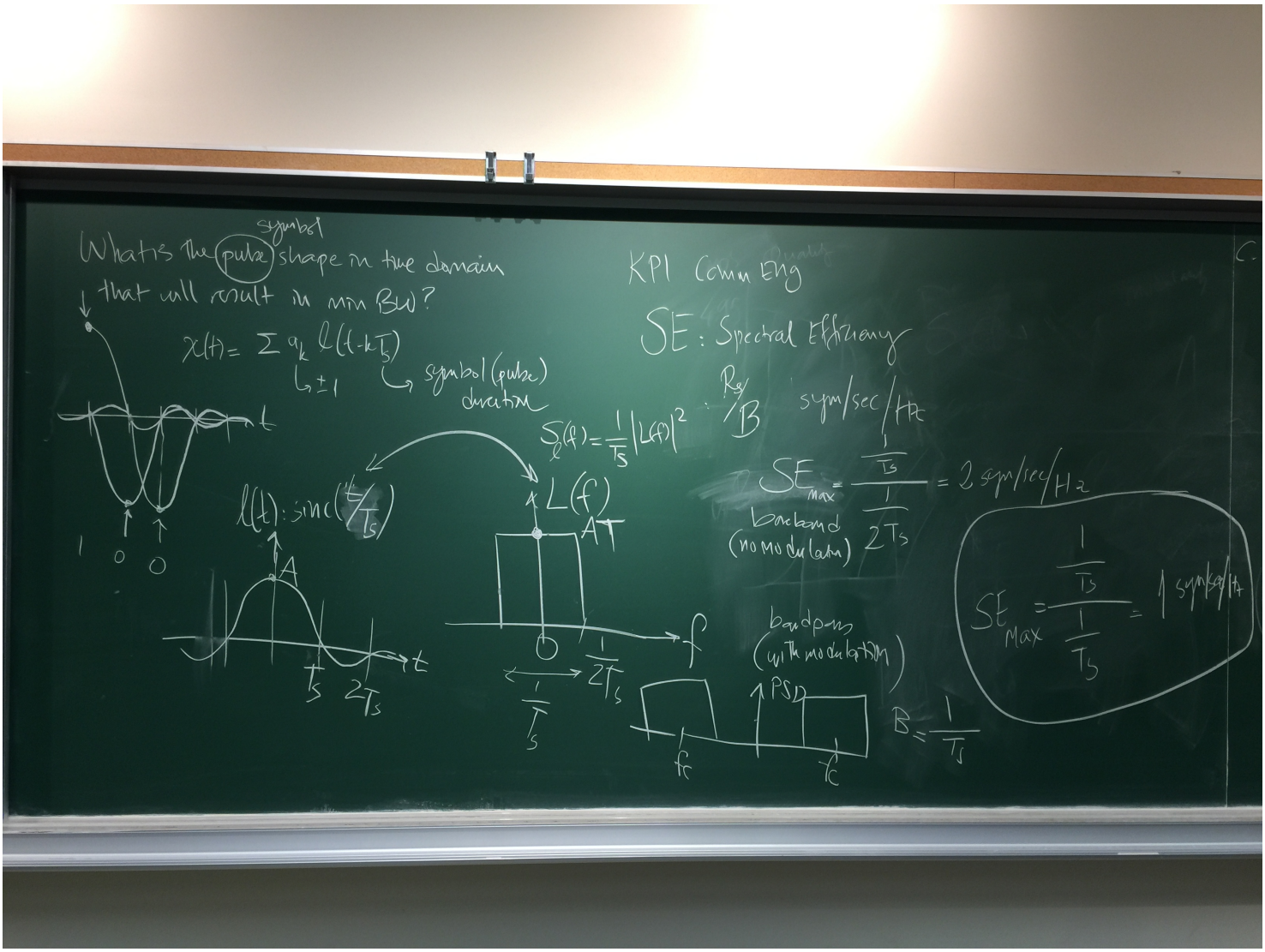
Null BW: $B = \frac{1}{T_b} = R_b$ (baseband)

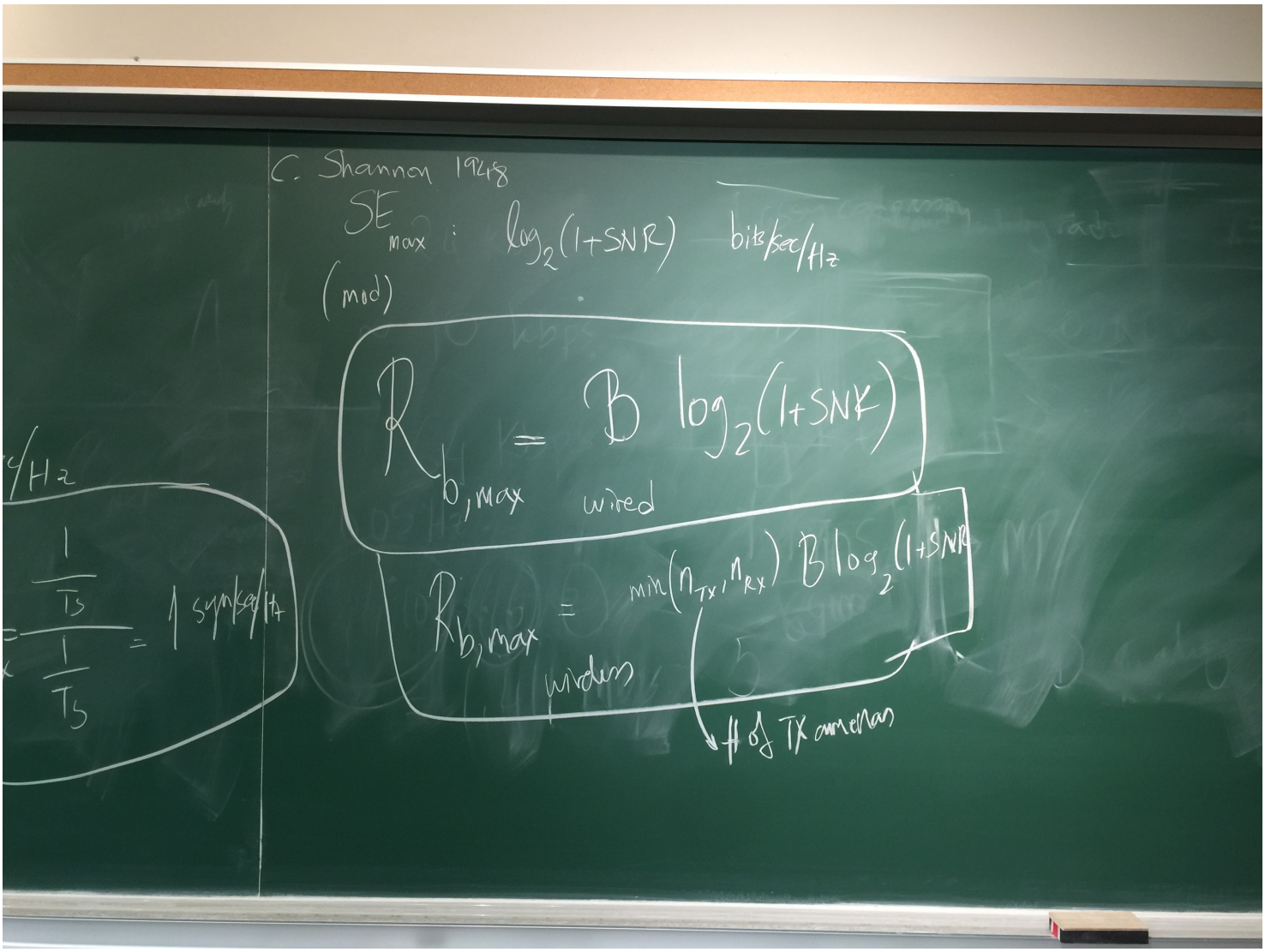
Ex: rect

$$x(t) = \sum a_k g(t - kT)$$

$$S_x(f) = \frac{1}{T}|H(f)|^2$$

$$S_x(f) = \frac{1}{T}|G(f)|^2$$


What is the pulse shape in time domain that will result in min BW?
symbol
$x(t) = \sum a_k \, l(t - kT_s)$
$a_k \pm 1$
symbol (pulse) duration
1 0 0
t
$l(t) = \text{sinc}(t/T_s)$
A
T_s $2T_s$
$S_x(f) = \frac{1}{T_s} |L(f)|^2$
L(f)
AT
f
$\frac{1}{T_s}$ $\frac{1}{2T_s}$
KPI Comm Eng
SE: Spectral Efficiency
R_b / B sym/sec/Hz
$SE_{max} = \frac{\frac{1}{T_s}}{2} = \frac{1}{2T_s}$ = 2 sym/sec/Hz
baseband (no modulation)
bandpass (with modulation)
PSD
f_c
$B = \frac{1}{T_s}$
$SE_{max} = \frac{\frac{1}{T_s}}{\frac{1}{T_s}} = 1$ sym/sec/Hz


C. Shannon 1948
SE max : log2(1+SNR) bits/sec/Hz
(mid)
Rb,max = B log2(1+SNR)
wired
Rb,max = min(nTx, nRx) B log2(1+SNR
wireless
# of TX antennas
1/Ts = 1 symbol/Hz
1/Ts