EE3731C:
Signal Processing Methods

Tutorial II-2

Question #1

For each of the following random processes, determine whether X(t) is wide sense stationary and ergodic.

a) $X(t) = \cos(2\pi f t + \theta)\ , \quad \theta \sim U[-\pi, \pi]$

Note that θ remains constant for each single realization.

b) $X(t) = A$ for all t, where A is a zero-mean random variable.

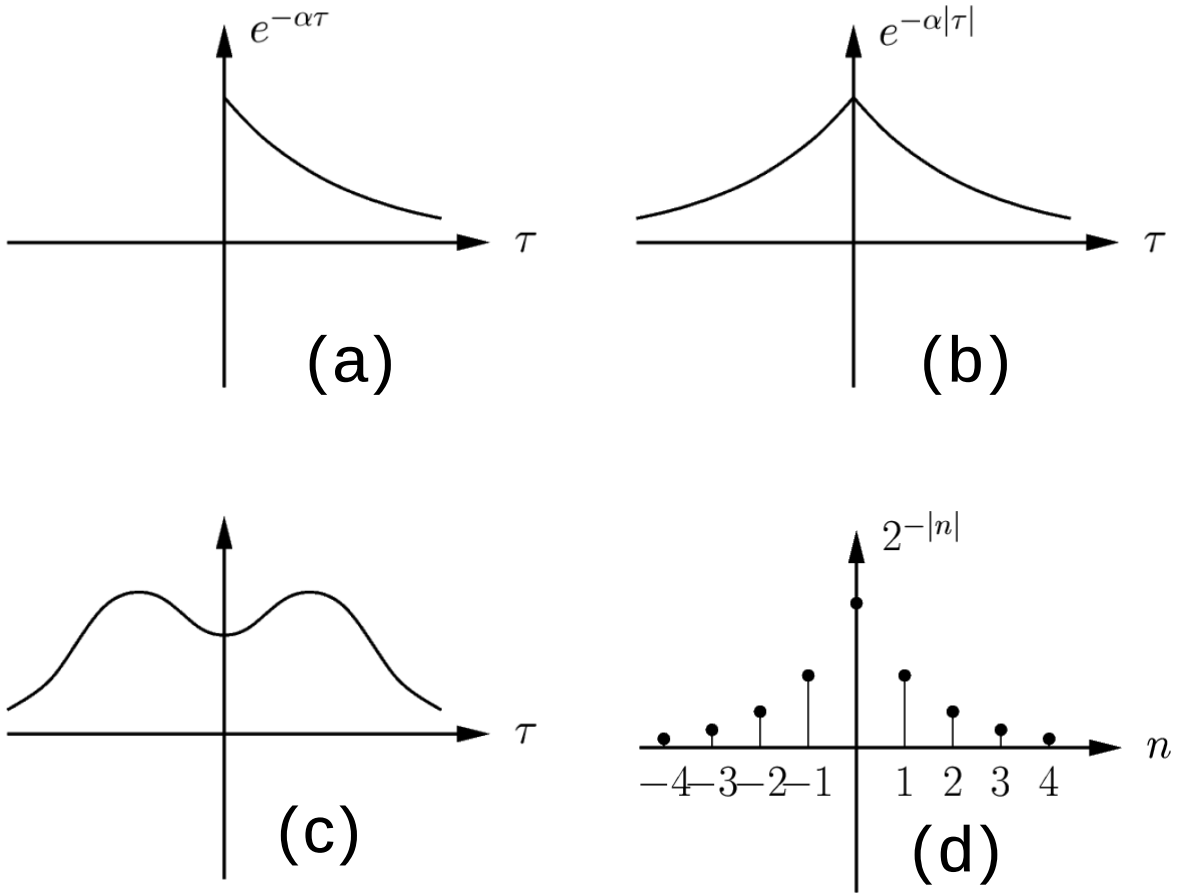
Question #2

Find the mean and autocorrelation functions of the following process:

$x[n] = A\cos(\omega n + \phi)$ with random phase ϕ, where A and ω are positive constants and $\phi \sim U(0, 2\pi)$.

Question #3

Which of the followings are autocorrelation functions of WSS processes?



Question #4

$x[n]$ is Gaussian i.i.d., that is, $x[n]$ are sampled independently and identically from the same Gaussian distribution with zero mean and variance σ^2.

Let $y[n] = x[n] + x[n-1]$. Find the cross-correlation function between $x[n]$ and $y[n]$, as well as, the autocorrelation function of $y[n]$.