EECS 361
Test 2 Topics

1) Model periodic signals using Fourier Series
   a) Complex exponential form, $\mathbf{x}_n$'s
   b) Sine/Cosine form, a_n's and b_n's
   c) Cosine form c_n's
   d) Determine the fundamental frequency of periodic signals
   e) Determine DC (average value, $\mathbf{x}_0$, a_0, c_0) of periodic signal
   f) Apply signal symmetry properties to simplify finding a_n's b_n's, c_n's, $\mathbf{x}_n$'s,
2) Finding power of periodic signals using Parsaval's theorem
3) Draw spectral plots for periodic signals, magnitude spectrum (two sided)
4) Determine the output of linear time-invariant systems to periodic input
5) Find the Fourier Transform of aperiodic signals
6) Find the Fourier Transform of periodic signals
7) Find the Fourier Series of a periodic signal using the relationship between Fourier Transform and Fourier Series

$$x_P(t) = \sum_{k=-\infty}^{\infty} x(t-kT_0) = \sum_{n=-\infty}^{\infty} x_n e^{jn\omega_0 t}$$

$$x(t) \leftrightarrow X(\omega)$$

$$x_n = \frac{1}{T_0} X(n\omega_0)$$

8) Apply the Fourier Transform theorems and properties
9) Find signal energy using Parsaval's theorem for aperiodic signals
10) Determine the Transfer Function of linear time invariant systems - $H(\omega)$
11) Find the amplitude and phase response of linear time invariant systems
12) Determine the output of a system given its input
13) Understand the concept of bandwidth and the inverse signal duration/bandwidth relationship
    - First zero definition
    - 3 dB definition
    - Inverse time duration-bandwidth relationship
14) Criteria for an ideal linear time invariant system – Ideal Filters
    a) Distortionless transmission $y(t)=Kx(t-\tau)$ $H(\omega)=Ke^{-j\omega\tau}$ for all ω.
    b) ILPF → $H(\omega)=Ke^{-j\omega\tau}$ over the signal bandwidth
    c) IBPF, IBRF, IHPF
    d) If $B_{System} >> B_{signal}$ then minimal distortion, where B_{System}=system bandwidth and B_{signal}=signal bandwidth
16) Basic modulation: DSB-SC, DSB-LC (AM), and FDM
17) Sampling
    a) Sampling Theorem
    b) Sampling rate $f_s>2B$ (Nyquist sampling rate =2B)
    c) Spectrum of a sampled signal
    d) Recovery of $x(t)$ from $x_s(t)$ using an LPF

18) Discrete Time Signals and Systems

a) Discrete signal notation, e.g., {a, b, $\underline{c}$, d,….} then x[0]=c
b) Discrete Time Signals x[n], u[n], δ[n], cos(Ωn+φ), $\mathbf{p}^n$u[n]
   where Ω= the discrete-time angular frequency
c) Discrete time LTI systems
   - Difference equations
   - ARMA format for difference equations
   - Block diagrams with delay blocks
   - Properties of Discrete Time Systems
     - Linearity
       - Scaling
       - Additivity
     - Time-invariance
     - Memoryless (static) vs Memory (dynamic)
     - BIBO stable
     - Casual
     - Discrete time impulse response, h[n]
d) Discrete Time Convolution