EECS 361
Test 2 Topics

1) Find the Fourier Transform of aperiodic signals
2) Find the Fourier Transform of periodic signals
3) Find the Fourier Series of a periodic signal using the relationship between Fourier Transform and Fourier Series

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

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

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

4) Apply the Fourier Transform theorems and properties to find X(ω)
5) Find signal energy using Parsaval's theorem for aperiodic signals
6) Determine the Transfer Function of linear time invariant systems - H(ω)
   Finding H(ω) from LCCDE
7) Find the amplitude and phase response of linear time invariant systems
8) Determine the output of a system given its input
9) Understand the concept of bandwidth and the inverse signal duration/bandwidth relationship
   - First zero definition
   - 3 dB definition
   - Inverse time duration-bandwidth relationship
10) 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: Transmitters and Receivers
17) Sampling
    a) Sampling Theorem
    b) Sampling rate $f_s > 2B$ (Nyquist sampling rate =2B)
    c) Spectrum of a sampled signal
    d) Aliasing; causes and remedies
    e) 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, 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]
19) Discrete Time Convolution
20) z-transform
   a) Finding X(z) given x[n]
   b) Finding x[n] given X(z)
   c) Finding transfer function H(z) given
      - The impulse response
      - Difference equation
      - Block diagram
   d) Finding locations of poles and zeros of H(z)
   e) Finding frequency response $H(e^{\Omega})$ and its relationship to the unit circle.