EE431 Final Examination
Student Objectives

Graphical Convolution
- Given two sequences x[n] and h[n], find y[n] using graphical convolution

Finding output given system and input
- Be able to calculate y[n] given x[n] and DE or H(z) or h[n] using Z transforms
- Be able to calculate the x[n] needed to generate a given y[n] given system DE or H(z) or h[n]

DTFT/DFT
- Given a signal x[n], find its DTFT $X(e^{j\omega})$ and its DFT X[k] using the mathematical sum definition or its DTFT by inspection if x[n] is finite length
- Given DTFT, find the DFT X[k] from the DTFT – ie $X[k] = X(e^{j2\pi k/N})$
- Given a signal's DTFT or DFT and f_s, find the amount of signal energy corresponding to a given frequency in Hz
- Work the above problem in reverse; ie given frequency in Hz and a signal's f_s, find the ω (for the DTFT) or index k (for the DFT) corresponding to the given frequency
- Describe the effects of zero padding at the start or end of x[n] on its DTFT and DFT
- Explain how to zero pad to make circular convolution equal to linear convolution. Be able to find the circular and linear convolution of two sequences using their DFT's, or by graphical convolution.
- Describe the symmetry, real/imaginary, and periodic properties of the DTFT and DFT. Explain the relationship between the symmetry and periodic properties of a signal x[n] and its DTFT and DFT.
- Given a SSS $x[n] = A\cos(\omega n)$ and a system's $H(e^{j\omega})$, find the SSS output y[n].
- Given a SSS-like input $x[n] = A\cos(\omega t)\,u[n]$ and an FIR system's $H(e^{j\omega})$ and length of h[n], find when the output y[n] is equal to the SSS output (i.e. find when the startup transients caused by the u[n] in the input decay away).

Z transforms
- Given a signal x[n] find X[z] using the mathematical definition of the Z transform
- Given a signal x[n] find X[z] using tables and properties
- Given a finite-length signal x[n], find X[z] by inspection

Inverse Z transforms
- Given a X[z] find x[n] using PFE's and tables
- Given a X[z] find the first N samples of x[n] using long division
- Given a X[z] with a denominator of 1 find x[n] by inspection

Pole-zero plot
- Be able to identify what a filter does (LP, BP, BS, HP) given its pole/zero diagram
- Be able to identify if a pole/zero plot is FIR, IIR
- Add poles and zeros to a given pole/zero plot to make it linear phase

Block diagrams → H(z) ↔ h[n] ↔ DE
- Given a system described by any of the above 4 methods, be able to convert it to any of the other 3

Sampling
- Given an analog frequency in Hz and a f_s or T_s, find the digital frequency ω after sampling, and tell whether or not aliasing occurred. Explain how to specify an antialiasing filter before the A/D converter.

Real-World Filter Design
- Be able to determine filter coefficients using filterDesigner given filter specifications

- Be able to choose FIR vs. IIR (and which kind: Bessel, Butterworth, Chebychev, or Elliptic) given an application