**Note: For this assignment, your Handwritten, hard-copy solution is**

**due on or before December 22nd, 2012.**

**Question No. 1**

Given the following difference equation,

1. Find the transfer function;
2. Determine the impulse response if the input is;
3. Determine the step response if the input is.

**Question No. 2**

Given the following difference equation,

1. Find the transfer function;
2. Determine the impulse response if the input is;
3. Determine the step response if the input is.

**Question No. 3**

Convert each of the following transfer functions into its difference equation

**Question No. 4**

Convert each of the following transfer functions into its pole-zero form

**Question No. 5**

Given each of the following transfer functions describe digital systems, sketch the z-plane pole-zero plot and determine the stability status for the digital system.

**Question No. 6**

Given the following digital system with a sampling rate of 8000 Hz,

1. Determine the frequency response of the system;
2. Calculate and plot the magnitude and phase frequency responses;
3. Determine the filter type, based on the magnitude frequency response.

**Question No. 7**

Given the following digital system with a sampling rate of 8000 Hz,

1. Determine the frequency response of the system;
2. Calculate and plot the magnitude and phase frequency responses;
3. Determine the filter type, based on the magnitude frequency response.

**Question No. 8**

Given the following difference equation for a digital system,

where and,

1. Find the transfer function;
2. Plot the poles and zeros on the z-plane with the unit circle;
3. Determine the stability of the system from the pole-zero plot;
4. Calculate the amplitude (magnitude) frequency response of;
5. Calculate the phase frequency response of;

**Question No. 9**

Given the first-order IIR system

Realize and develop the difference equations using the following forms:

1. Direct-form I
2. Direct-form II

**Question No. 10**

Given the filter

Realize and develop the difference equations using the following forms:

1. Direct-form I
2. Direct-form II
3. Cascade (series) form via the first-order sections
4. Parallel form via the first-order sections

**MATLAB Problems**

**Question No. 11**

Given the filter

Use MATLAB to plot:

1. Its magnitude frequency response;
2. Its phase frequency response.

**Question No. 12**

Given the difference equation

1. Use the MATLAB functions **filter()** and **filtic()** to calculate the system response for with the input of and initial conditions: and;
2. Use the MATLAB functions **filter()** and **filtic()** to calculate the system response for with the input of and zero initial conditions: and.

**Question No. 13**

Given the filter

1. Plot the magnitude frequency response and phase response using MATLAB;
2. Specify the type of filtering;
3. Find the difference equation;
4. Perform filtering, that is, calculate for the first 1000 samples for each of following inputs using MATLAB, assuming that all initial conditions are zeros and the sampling rate is 8000Hz:
5. (3)
6. Repeat part (d) using MATLAB function **filter()**.