1. Write the matlab program **P1.m** to sketch the signal in range **[-30,30]**. Evaluate then its energy.

$$x(n) = 3e^{-|n|/14}.cos(200\pi n).[u(|n|-3) - u(|n|-11) + u(|n|-20) - u(|n|-26)]$$

2. The transfer functions of two discrete time systems are given below:

$$H_1(z) = \left(\frac{0.3 - 0.2z^{-1} + 0.4z^{-2}}{1 + 0.9z^{-1} + 0.8z^{-2}}\right)\left(\frac{0.2 - 0.5z^{-1} + 0.3z^{-2}}{1 + 0.7z^{-1} + 0.85z^{-2}}\right)$$

$$H_2(z) = \frac{0.45 + 0.5z^{-1} + 0.45z^{-2}}{1 - 0.53z^{-1} + 0.46z^{-2}}$$

a. Write the matlab program **P2.m** to sketch the first *20* samples of two above impulse responses by using two commands of ***impz*** and ***filter***. Two figures, *Fig.1* and *Fig.2*, are used in this case.

b. Modify the program **P2.m** to sketch two step responses in range of *n* from *0* to *50*. Using the *Fig.3* in this case.

c. Modify the program **P2.m** to sketch the output of each system to the swept-frequency sinusoidal which its frequency increases linearly respect with the time. Assume that this input has its amplitude of *2* and its angular frequency in range *0* to *pi*. Repeat if two systems are connected in cascade. The given range of *n* is from *0* to *60*. One figure named *Fig.4* is only used in this case.

d. Investigate the filtering concept of two systems using the figure *Fig.5*.

e. Plot the pole-zero patterns of two systems. Plot the pole-zero pattern and investigate the stability and the casuality of the cascade-connected system. Figure *Fig.6* is used in this case.

3. Write the matlab program **P3.m** to investigate the following property of the *Discrete Time Fourier Transform*:

$$x(n).y(n) \leftrightarrow \frac{1}{2\pi}[X(\Omega) * Y(\Omega)]$$