Practice Questions for Unit 4 of DSP

Questions Based on Design of IIR Filter

Question 1

(a) Write down formula for getting H(Z) using Bilinear Transformation and Impulse Invariant Transformation. What are advantages and disadvantages of Bi linear Transformation and Impulse Invariant Transformation.
(b) If H(s) = {8 / (S+5)(S+9)} then determine H(z) using impulse invariant transformation.
(c) Derive expression of S = (2/T)*((Z-1) / (Z+1)) which is used to get H(z) using Bilinear Transformation. Also derive generalised expression of transfer function H(z) using impulse invariant method.
(d) Explain Butterworth filter with the help of generalised expression of magnitude response. Draw the graph of magnitude response of Butterworth filter for different values of order N. Justify that as order N approaches infinity, magnitude response of filter approaches towards an ideal filter. Also discuss passband attenuation and stopband attenuation.
(e) Discuss one to one mapping in case of Bilinear Transformation. Also explain effect of frequency warping.
(f) Explain design methodology of infinite impulse response (IIR) filter if passband frequency, stopband frequency, passband gain and stopband gain of corresponding analogue filter is given.
(g) What are various types of methods to design IIR filter. What are the differences between IIR filter and FIR filter?
(h) If H(s) = {5 / (S+7)} then determine H(z) using impulse invariant transformation.
(i) Design 2nd order discrete time Butterworth filter using Bi-linear Transformation if cut off frequency is 2KHz and sampling frequency is 30000 samples per second.
(j) Discuss the mapping from S-plane to Z plane in case of impulse invariant transformation and also for Bilinear Transformation
(k) If H(s) = {7 / (S+4)(S+6)} then determine H(z) using Bilinear transformation.

Questions Based on Design of FIR Filter

Question 2

(a) Design a high pass filter using Hamming window with cut-off frequency of 2 radian/ second and filter length N=7
(b) Design a bandpass filter to pass frequencies in the range 2 to 5 radian/second using Hanning window if length of the filter is N = 9
(c) Explain windowing technique for design of FIR filter.
(d) Discuss Kaiser Window. Also, explain, why Kaiser Window has better features.
(e) Discuss various window functions using their mathematical expression and their graph in time domain.
(f) Why FIR filter is always stable and justify it with the help of suitable example.