



13. (a) (i) Obtain the direct form I, direct form II, cascade and parallel form realization for the system
- $$y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2). \quad (8)$$

- (ii) For the analog transfer function  $H(s) = \frac{2}{(s+1)(s+2)}$ . Determine  $H(z)$  using impulse invariance method. Assume  $T = 1$  sec. (8)

Or

- (b) A low pass filter meeting the following specifications is required :

Passband	-	0-500 Hz
Stopband	-	2-4 kHz
Passband ripple	-	3 dB
Stopband attenuation	-	20 dB
Sampling frequency	-	8 kHz

Determine the following :

- (i) Pass and stopband edge frequencies for a suitable analog prototype low pass filter.
- (ii) Order  $N$  of the prototype low pass filter.
- (iii) Coefficients and hence the transfer function of the discrete time filter using the bilinear  $z$ -transform.

Assume Butterworth characteristics of the filter. (16)

14. (a) (i) Given a three stage lattice filter with coefficients  $K_1 = \frac{1}{4}$ ,  $K_2 = \frac{1}{4}$ ,  $K_3 = \frac{1}{3}$ , determine the FIR filter coefficients for the direct form structure. (8)

- (ii) Determine the coefficients of a linear phase FIR filter of length  $M = 15$  has a symmetric unit sample response and a frequency response that satisfies the conditions  $H\left(\frac{2\pi k}{15}\right) = \begin{cases} 1 & k=0, 1, 2, 3 \\ 0 & k=4, 5, 6, 7 \end{cases}$  (8)

Or

- (b) Design an ideal high pass filter with a frequency response

$$H_d(e^{j\omega}) = \begin{cases} 1 & \text{for } \frac{\pi}{4} \leq |\omega| \leq \pi \\ 0 & \text{for } |\omega| \leq \frac{\pi}{4} \end{cases}$$

Find the value of  $h(n)$  for  $N=11$  using hamming window. Find  $H(z)$  and compute magnitude response. (16)

15. (a) (i) Explain the method for converting the sampling rate by a factor I/D with block diagram and equations. (8)
- (ii) Discuss sub band coding process in detail. (8)

Or

- (b) (i) With block diagram explain adaptive filtering based adaptive channel equalization. (8)
- (ii) What is image enhancement? Explain various image enhancement techniques. (8)