



11. (a) (i) Find the inverse Z-Transform of  

$$X(z) = \frac{z^2 + z}{(z-1)(z-3)}, \text{ ROC: } |z| > 3,$$
 using  
 (1) Residue method and (8)  
 (2) Convolution method. (8)

(ii) State and prove circular convolution. (8)

Or

- (b) LTI system is described by the difference equation  
 $y(n) = ay(n-1) + bx(n)$ . Find the impulse response, magnitude  
 function and phase function. Solve  $b$ , if  $|H(\omega)| = 1$ . Sketch the  
 magnitude and phase response for  $a = 0.6$ .

12. (a) (i) Evaluate the 8-point for the following sequences using DIT-FFT  
 algorithm (8)

$$x(n) = \begin{cases} 1 & \text{for } -3 \leq n \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

- (ii) Calculate the percentage of saving in calculations in a 1024-  
 point radix-2 FFT, when compared to direct DFT. (8)

Or

- (b) Determine the response of LTI system when the input sequence  
 $x(n) = \{-1, 1, 2, 1, -1\}$  by radix-2 DIT FFT. The impulse response of the  
 system is  $h(n) = \{-1, 1, -1, 1\}$ . (16)

13. (a) The specification of the desired lowpass filter is

$$\frac{1}{\sqrt{2}} \leq |H(\omega)| \leq 1.0; 0 \leq \omega \leq 0.2\pi$$

$$|H(\omega)| \leq 0.08; 0.4\pi \leq \omega \leq \pi$$

Design a Butterworth digital filter using bilinear transformation. (16)

Or

- (b) The specification of the desired low pass filter is

$$0.9 \leq |H(\omega)| \leq 1.0; 0 \leq \omega \leq 0.25\pi$$

$$|H(\omega)| \leq 0.24; 0.5\pi \leq \omega \leq \pi$$

Design a Chebyshev digital filter using impulse invariant  
 transformation. (16)



14. (a) (i) Design a single tier notch filter to reject frequencies in the range 1 to 2 rad/sec using rectangular window with  $N = 7$ . (8)
- (ii) Compare Hamming window and Kaiser window. (8)

Or

- (b) (i) Explain the characteristics of a limit cycle oscillation with respect to the system described by the equation  $y(n) = 0.95 y(n-1) + x(n)$ . Determine the dead band of the filter. (8)
- (ii) Explain Gibb's phenomenon (or Gibb's oscillation). (8)
15. (a) Explain the methods of speech analysis and synthesis in detail. (16)

Or

- (b) Explain how image enhancement restoration and coding can be done using signal processing. (16)